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Troubleshooting Assessment and Enhancement (TAE) Program: Test and Evaluation

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13 ABSTRACT *(Maximum 200 words)*

The purpose of the Troubleshooting Assessment and Evaluation (TAE) program was to develop a low-cost, microcomputer-based system to provide an objective measure of the troubleshooting proficiency of Navy technicians. This technical note presents the results and conclusions of the test and evaluation of the demonstration system.

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FOREWORD

Troubleshooting Assessment and Enhancement (TAE) Program (previously titled Troubleshooting Proficiency Evaluation Program, TPEP) was sponsored by the Deputy Chief of Naval Operations (OP-11) and was performed under 0603720N-R1772-ET01. The purpose of the TAE program was to develop a low-cost microcomputer-based system to provide an objective measure of the troubleshooting proficiency of Navy technicians.

This technical note is the last of three that document the TAE program. It presents findings from the test and evaluation effort conducted at the Advanced Electronics School Department, Service Schools Command, Navy Training Center, San Diego, California. Using troubleshooting episodes developed and presented on the TAE computerized delivery system, students and instructors at the school were assessed on their troubleshooting performance. Results were determined, conclusions drawn, and recommendations made. Recommendations focus on enhancing the effectiveness of the current TAE delivery system and the corresponding troubleshooting episodes.

The first technical note presents the results of the literature survey, the theoretical and methodological issues that were to be considered, and the proposed test and evaluation plan for the TAE effort (Conner & Hassebrock, 1991). The second technical note presents the design and development of the computerized troubleshooting proficiency evaluation system (Conner, Poirier, Ulrich, & Bridges, 1991).

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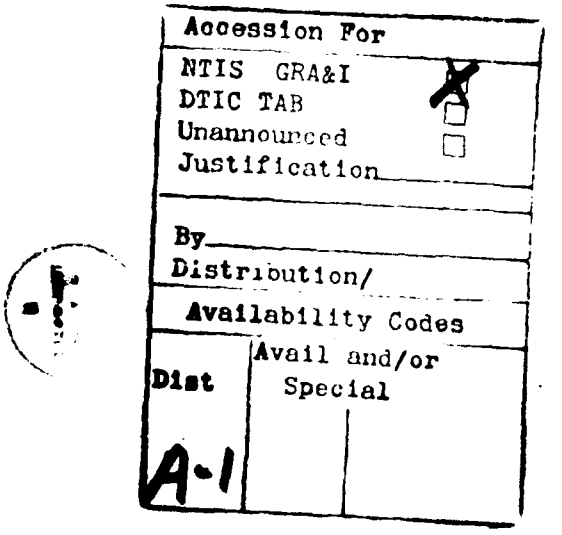

SUMMARY

Problem

The Navy has limited means of measuring the troubleshooting proficiency of Navy technicians and their ability to contribute to operational readiness. There is limited capability to maintain or enhance troubleshooting skills on-board ships or at Reserve Readiness Centers, or to evaluate overall troubleshooting capability so that feedback can be provided to the training command to improve troubleshooting skills training in the schools.

Purpose

The purpose of the Troubleshooting Assessment and Evaluation (TAE) program was to develop a low-cost, microcomputer-based system to provide an objective measure of the troubleshooting proficiency of Navy technicians.

The TAE effort resulted in the development of a troubleshooting proficiency demonstration for the maintainers (NEC ET-1453s) of the Naval Modular Automated Communications System(V)/ Satellite Communications (NAVMACS V/SATCOM) hardware. The test and evaluation plan was designed to assess the TAE system, validate the TAE troubleshooting episodes, and assess the reliability and effectiveness of the episodes in evaluating performance of troubleshooting technicians.

Method

The TAE episodes were constructed, the troubleshooting evaluation factors were determined and weighted, the research subject groups were defined, and the specific research objectives were delineated. Seven research areas with 22 hypotheses were identified.

The TAE test was administered to students in the system phase of the course and to qualified instructors (NEC ET-1453) in a classroom at the school. The subjects went through a learn program, 2 practice episodes and 14 test troubleshooting episodes.

Demographic and performance data were collected for 53 students and 13 instructors. The data were evaluated for completeness, descriptive statistics were inspected, and any deficiencies or anomalies were resolved. The data were analyzed to relate TAE performance to hypotheses in the seven research areas: experience, electronics knowledge, electronics performance proficiency, difficulty level (of troubleshooting episodes), time, (use of) complex test equipment, and ranking (of subjects).

Results and Conclusions

1. There was no general statistically significant relationship between experience and TAE troubleshooting performance on the two hypotheses tested. One hypothesis was dropped due to lack of fleet subjects.

2. There was, generally, no consistent relationship between electronics knowledge and TAE performance on the three hypotheses tested.

3. There was a general and consistent, significant relationship between the electronics performance proficiency measures and TAE performance on the six hypotheses tested.

4. There was a general and consistent, significant relationship between the difficulty of the episodes and the TAE performance on the three hypotheses tested. One hypothesis was dropped due to the lack of fleet subjects.

5. There was a general and consistent, significant relationship between time and TAE results on the two hypotheses tested.

6. There was no significant relationship between test equipment usage and TAE performance results on the one hypothesis tested.

7. There was no significant relationship between the subject rankings and TAE performance on the three hypotheses tested.

Future Efforts

The following future efforts are recommended:

1. Further investigate TAE as related to validity and reliability.

2. Further investigate TAE as related to experience and troubleshooting performance.

3. Further investigate TAE as related to "academic" and "knowledge" factors.

4. Further investigate the relationship between selection requirements and troubleshooting performance.

5. Further analyze the TAE data and results to improve the discriminatory and predictive accuracy of the TAE approach.

6. Further test the TAE approach on other subjects and on other equipment and equipment types.

7. Develop additional troubleshooting episodes to provide directive training, guided training, and tests with feedback.

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INTRODUCTION

Problem

Currently the Navy has limited means of objectively measuring the troubleshooting proficiency of shipboard technicians and their ability to contribute to operational readiness. Other than subjective supervisory opinion, there is no consistent and reliable way to assess the transfer of training, particularly hands-on training on hardware systems provided in Navy "C" schools. Once the "C" school graduate has been integrated into the ship's force, fleet commanders have no comprehensive method to assess the technician's performance capabilities or skill degradation over time. In addition, the schools receive no quantifiable feedback identifying specific areas where troubleshooting training requires greater emphasis or improvement.

Due to limited availability of system hardware at "C" schools, actual hands-on training time is severely restricted. This limits the amount of time students explicitly use their system knowledge and, therefore, decreases the effectiveness of instructional programs. Once on-board, the ship safety hazards associated with corrective maintenance of weapon system hardware preclude the use of drill and practice exercises. This limits the technician's ability to maintain or improve troubleshooting skills.

Purpose

The purpose of the Troubleshooting Assessment and Evaluation (TAE) program was to develop a low-cost, microcomputer-based system to provide an objective measure of the troubleshooting proficiency of Navy technicians.

The TAE effort resulted in the development of a troubleshooting proficiency demonstration for the high-technology (electronic/digital) maintainer community (NEC ET-1453) for the Naval Modular Automated Communications System(V)/Satellite Communications (NAVMACS(V)/ SATCOM) hardware system.

This report documents the test and evaluation of the TAE demonstration in the training environment. Specifically, the test and evaluation were designed to (1) assess the TAE troubleshooting evaluation and diagnostic factors, (2) validate the ability of the TAE episodes to evaluate and diagnose troubleshooting proficiency, and (3) assess the reliability and effectiveness of the TAE episodes to evaluate troubleshooting proficiency, diagnose results, and lead to improved training and performance.

Background

The specific objectives of the TAE project were to support the Navy operational and training communities by providing a microcomputer-based system to (1) assess personnel troubleshooting capabilities within the Navy training environment (e.g., "C" school and/or reserve training activities), (2) develop drill and practice for personnel in training awaiting hardware availability or active duty assignments, (3) improve curricula and training methods based on school troubleshooting assessment results, (4) provide fleet and reserve on-board training (OBT) through drill and practice exercises, (5) develop an objective measure of operational readiness of fleet and

reserve personnel in their area of systems hardware troubleshooting capability, (7) improve operational readiness, and (8) improve curricula and instructional methods as a result of operational fleet and reserve feedback of assessment/evaluation data to the training community.

The ultimate benefits to be realized as a result of the TAE program include (1) improvement of operational readiness defined in terms of reduction in Mean Time To Repair (MTTR), increase in Mean Time Between Failures (MTBF), reduction in No Fault Removals (NFRs) (i.e., return of unfailed parts), (2) improvement of curricula and instructional methods as a result of consistent and objective operational fleet feedback of assessment/evaluation data to the training community, and (3) improvement of the training community's ability to objectively evaluate student troubleshooting performance.

The TAE effort was organized into three phases: design, development, and test and evaluation. The phases included the following activities:

1. Selection of the NAVMACS(V)/SATCOM hardware system and the NEC ET-1453 maintainer community for the demonstration.

2. Review of the literature to provide input into the design and development of the troubleshooting episodes and the test and evaluation procedures.

3. Design and development of computer software to support the evaluation program.

4. Design and development of the troubleshooting episodes selected as representative for the demonstration maintenance community.

5. Design and development of training assessment and training drill and practice episodes.

6. Design and development of a troubleshooting episode development capability to be used for other hardware systems.

7. Development of factors for evaluating troubleshooting proficiency.

8. Development of a test and evaluation plan stating the research hypotheses and analysis techniques.

9. Data collection, analysis, and reporting for the test and evaluation.

The review of literature and a discussion of the theoretical and methodological issues in TAE design and the initial test and evaluation plan (Steps 1 and 2) are documented in Conner and Hassebrock, 1991); the TAE computer software design and development efforts (Steps 3 through 6), in Conner, Poirier, Ullrich, and Bridges (1991).

The following paragraphs (1) define the TAE demonstration problem set, (2) describe the development of the evaluation factors for troubleshooting proficiency, (3) define the test and evaluation subject groups, (4) identify the research objective of the test and evaluation, and (5) state the TAE research hypotheses. The remaining sections of the report describe the method, results, conclusions and recommendations of the TAE demonstration test and evaluation.

Appendixes A and B provide detailed test and evaluation data. Appendixes C and D provide copies of the questionnaires used in the development and weighting of the TAE factors.

TAE Episodes

Within the context of the TAE demonstration, troubleshooting is viewed as part of the corrective maintenance function. When a system is not functioning properly, corrective maintenance must be performed to return the system to an optimum operational state. Troubleshooting is the means by which the faulty component of the system is identified. Once identified, the faulty components can be repaired/replaced. Figure 1 displays this relationship. The TAE episodes were designed to measure the ability to troubleshoot by identifying the faulty component

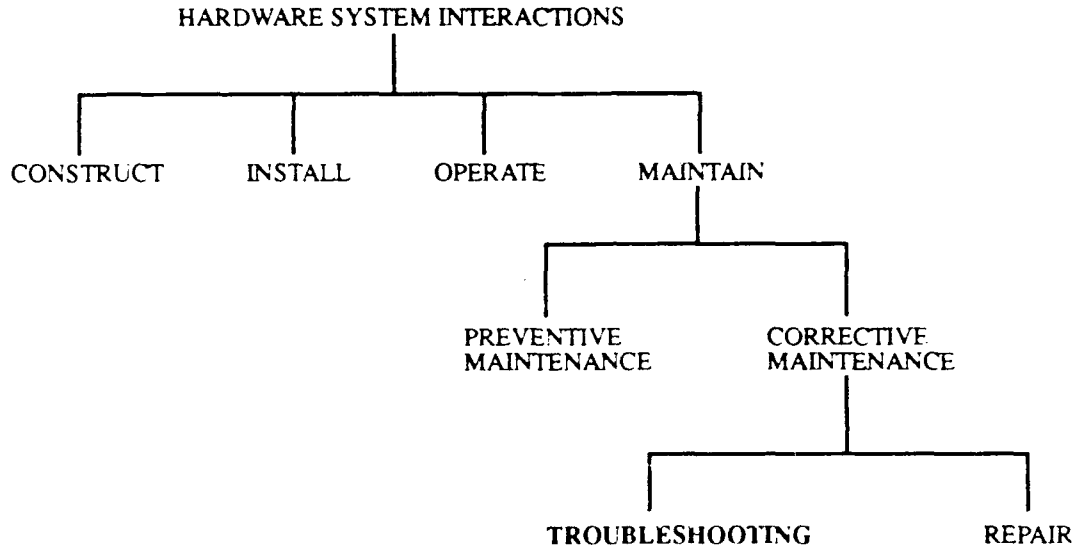

Figure 1. Hardware activity to troubleshooting.

The TAE testing format begins by displaying fault indicators. The subject uses a series of menus to review fault symptoms, front panels, maintenance panels, and diagnostic information; to select equipment, to make reference designator tests or replace a Lowest Replaceable Unit (LRU). The subject's goal in the TAE test is to find the faulty LRU as defined by the maintenance philosophy of the system. This is done by selecting the suspected LRU for replacement. It is possible for the fault symptom to logically lead to an LRU that is not the faulty LRU as defined by the episode. This is indicated as a GOOD FAULT but not the specific faulty LRU.

The troubleshooting assessment episodes were developed for seven of the eight NAVMACS(V)/SATCOM subsystems are listed below. No TAE episodes were developed for troubleshooting the TSEC/KG-36 due to the sensitivity and classification problems associated with this subsystem.

AN/USH-26(V) Subsystem

1. Formatter A
2. Formatter B
3. Servo/Data
4. Parallel Interface
5. Control

AN/USQ 69(V) Subsystem

1. Maintenance Panel Keyboard
2. Power Supply
3. CRT
4. 2nd, 3rd Page RAM
5. Microcontroller

AN/UYK-20(V) Subsystem

1. Channel 16 Interface
2. Micro Channel 15 and IO Oneshot Control
3. Channel 14 Interface
4. Memory Interface
5. Memory Interface

CV-3333/U Subsystem

1. Sample Processor Assembly
2. Sample Data Generator Assembly
3. Spectrum Analyzer No. 2
4. Handset
5. Analyzer and Synthesizer Analog
6. Voicing and Channel Encoder
7. Pitch Analyzer
8. Spectrum Analyzer No. 2
9. Timing and Interface
10. Timing and Self Test

ON-143(V)/USQ Subsystem

1. Level Converter
2. Transmit Sequence Control
3. Relay Card
4. Rec Synchronization
5. Red/Black Interface
6. Red/Black Interface Relay

RD-397U Subsystem

1. Punch Enable Signal
2. LDR Signal
3. OD 3 Signal

TT-624(V)5/UG Subsystem
1. Input & Buffer Data Registers
2. Hammer Drivers
3. Paper Feed Control Logic
4. Output Decode
5. Serial Interface Logic

The TAE testing episodes developed for the demonstration may be used as troubleshooting training exercises as well as troubleshooting assessment tools. There are five demonstration systems at the Fleet Training Center, Norfolk and six demonstration systems at the Advanced Electronic Schools Department, Service Schools Command, San Diego for training and evaluation purposes Although the test and evaluation plan focuses on the ability of TAE to assess troubleshooting proficiency, TAE should also be viewed in the broader context as an instructional tool.

In addition to these testing episodes, three other levels of TAE episode presentation were planned: directive training, guided training, and test with feedback. However, only 14 directive training episodes were developed (listed below) and no guided training episodes or tests with feedback were produced.

AN/USH-26(V) Subsystem
1. Servo Data
2. Control

AN/USQ-69(V) Subsystem
1. 2nd, 3rd Page RAM
2. Microcontroller

AN/UYK-20(V) Subsystem
1. Card Location J06
2. Card Location A24

CV-3333/U Subsystem
1. Spectrum Analyze
2. Synchronization, Control Logic

ON-143(V)/USQ Subsystem
1. Rec Synchronization
2. Transmit Sequence

RD-397U Subsystem
1. Punch Driver Assy
2. Reader Controller

TT-624(V)5/UG Subsystem
1. Output Decode
2. Serial Interface Logic

The directive training episodes are designed so that the student is, in effect, looking over the shoulder of an expert troubleshooter as a fault is discovered. The symptoms are provided and then information is presented on (1) what the symptoms should tell the troubleshooter, (2) what tests or checks should be made, and (3) what conclusions could be drawn from these tests or checks. Then, a test or check is accomplished. The results of the test or check are displayed, and the implication of that check or test are provided. This sequence is continued until the fault is identified. Throughout the sequence, the student observes the activity and follows the action in the technical manuals (TMs). Information and graphics from the TMs are provided in the presentation as appropriate

Troubleshooting Evaluation Factors

As stated earlier, the focus of the TAE episodes is fault diagnosis. The Navy electronics training schools identified the following six steps in the fault diagnosis process (Conner, 1987):

1. **Symptom Recognition.** The technician determines if there is a fault by checking system outputs.

2. **Symptom Elaboration.** The technician checks all possible indicators, built-in test features, refining the likely list of symptoms.

3. **Probable Faulty Functions.** The technician narrows the list of faults for testing purposes.

4. **Localizing the Faulty Function(s).** The technician checks outputs at test points to further eliminate areas or functions.

5. **Isolating the Faulty Circuit.** The technician narrows the fault suspect(s) to a particular circuit component.

6. **Failure Analysis.** The technician determines why malfunction occurred.

The microcomputer-based TAE episodes do not specifically test the first step, symptom recognition, or the last step, failure analysis. A fault indication is represented in the scenario and the student solves the problem to the lowest replaceable unit. Actual replacement of the unit in order to repair the failure involves motor skills that are not easily simulated. Nor is there any attempt to query students as to the reason the fault would have given the symptoms.

Steps 2 through 5 in the fault diagnosis process required a further breakdown to determine measurable troubleshooting proficiency factors. As part of the Troubleshooting Proficiency Evaluation Program for the NATO Seasparrow Surface Missile System, a panel of 25 experts (three civilian engineers and 22 Navy personnel in five different technical ratings) representing the Mobile Training Unit (MOTU), the "C" school, and the Shore Intermediate Maintenance Activity (SIMA) were assembled to further define the performance factors (Conner, 1986, 1987). Based on previous research and the expertise of the group, the following nine factors were identified:

1. Solution
2. Time
3. Cost

4. Proof Points
5. Out of Bounds
6. Test Points
7. Valid Check
8. Invalid Check
9. Illogical Approach

For the TAE demonstration, a questionnaire describing the nine performance factors as they relate to the evaluation of troubleshooting skills was developed. The questionnaire was disseminated to 1200 Navy high-technology maintenance personnel in technical environments and in the fleet. Respondents were asked to complete a background information form and then rank order the factors in order of importance. Since the relative importance of the factors may change with conditions, the following conditions were assumed: (1) non-combat, (2) normal day in home port, and (3) trouble was encountered during a normal systems check. A total of 750 questionnaires were returned and analyzed to rank the nine factors. A copy of the questionnaire and the analysis is contained in Appendix C.

Based on the results of the first questionnaire, a second questionnaire was administered to subject matter experts in troubleshooting Navy systems and equipment. The respondents were provided a list of the nine factors in rank order and asked to determine the weight that should be applied to each factor. A total of 45 questionnaires were returned and analyzed to assign weights. A copy of the questionnaire and analysis is contained in Appendix D.

Once the factors were ranked and weighted as shown in Table 1, the next step was to develop a "rational" scheme for scoring the episodes. Given that the intent of the scoring is to discriminate between levels of troubleshooting proficiency, it was determined that failure to solve the problem would result in a score of 0, solving the problem would result in a score of 100. There would be no partial score for factor 1. Therefore, the ability to discriminate between levels of troubleshooting proficiency would be based on the scoring the remaining factors.

Table 1

Ranking, Weighting, and Scoring Scale for Troubleshooting Evaluation Factors

Rank	Factor	Weight	Scoring Scale
1	Solution	42.78	100.00
2	Cost (Incorrect Solution)	13.13	23.98
3	Time	11.80	20.62
4	Proof Points	9.86	17.23
5	Illogical Approach	6.87	12.01
6	Invalid Checks	4.68	8.18
7	Out of Bounds	4.00	6.99
8	Number of Tests	3.21	5.61
9	Number of Checks	3.08	5.38

Since the activities that a subject performs during the episode are being recorded for further analysis of behavioral protocols, the data are available to develop a scoring scale to use for factors 2 through 9. The weights for the factors were converted into a scale equaling 100 points as shown in Table 1. The final score equals 100 points minus the sum of the points for each factor. The minimum score is 0 points. There are no negative scores. The scoring criteria for each factor is listed below:

1.	Solution	-100 for failure to discover fault
2.	Cost	-5 for each no fault replacement to maximum of -23.98
3.	Time	-.5 X total minutes to maximum of -20.62
4.	Proof Points	-points based on number of proof points to maximum of -17.23
5.	Illogical Approach	-6 for each illogical approach to maximum of -12.01
6.	Invalid Checks	-.8 X number of invalid checks to maximum of -8.18
7.	Out of Bounds	-.6 X number of out of bounds to maximum of -6.99
8.	Number of Tests	-.5 X number of tests to max of -5.61
9.	Number of Checks	-.5 X number of checks to max of -5.38

The factors listed below were incorporated into the TAE episodes as measures to evaluate and diagnose an individual's troubleshooting proficiency level. The cost factor in the questionnaires was changed to incorrect solutions to more accurately describe the actual behavior. As a result of the previous literature search (Conner & Hassebrock, 1991), another factor to record redundant checks was also added to the TAE scoring criteria.

1. **Correct Solution** indicates the troubleshooting problem is correctly solved, i.e., the faulty component is identified.

2. **Incorrect Solutions** indicate the number of LRUs identified as the faulty component that were not faulty.

3. **Total Time** is the total minutes from login to logout that it takes the subject to find the fault.

4. **Test Points** are the total valid reference designator tests.

5. **Proof Points** are test points that positively identify LRUs as faulty. Generally there will be at least two proof points associated with an LRU, an input and an output point.

6. **Invalid Checks** indicate an inappropriate test was performed at an appropriate test point. For example, a subject measures current where he should have been checking for voltage.

7. **Valid Checks** indicate an appropriate piece of test equipment was used at a test point. For example, a subject measures current where current should be measured.

8. **Redundant Checks** indicate the same test was made at the same test point at some time during the episode.

9. **Out-of-Bounds** indicates an inappropriate test point was selected. An example would be the selection of a test point that is not reasonably in the area of where the trouble is located.

10. **Illogical Approaches** indicate an inappropriate equipment selection occurred. For example, the subject begins testing on UNIT 7, when all the symptoms and indications are that the fault is with UNIT 1 and the solution could be accomplished starting at UNIT 1.

Figure 2 provides a pictorial representation of the TAE approach as well as the factor relationships. One of the problems in the past in developing "real hardware" troubleshooting episodes is the number and type of tests and test points that must be provided if the "entire" universe of troubleshooting is available. If all options are made available for even one fault symptom the amount of computer memory required is extremely large. Given the intent of TAE is to assess troubleshooting proficiency, only the test points dictated by the symptom were included in the "approved" list of test points. This was done to keep the required number of test points to a manageable set (i.e., a "troubleshooting spectrum") with all others to be recorded as "out of bounds." The test point set for a troubleshooting episode was further reduced by the factor of illogical approach. The rationale here, given the intent of TAE, was that even though one could ultimately arrive at a problem solution and the point of departure was "within bounds," the approach was not appropriate given the symptom. Further, given the input-conversion-output concept of electronic circuitry, some tests that MUST be made to "prove" a component is faulty (i.e., proof points). Also, given a set of fault symptoms, it is postulated that there is an "optimum path" (i.e., series of tests that should be made) to the faulty component. The current form of TAE has developed the capability to evaluate all factors as described. However, it has not developed the "optimum path" as yet. This was expected to be accomplished empirically once data were collected.

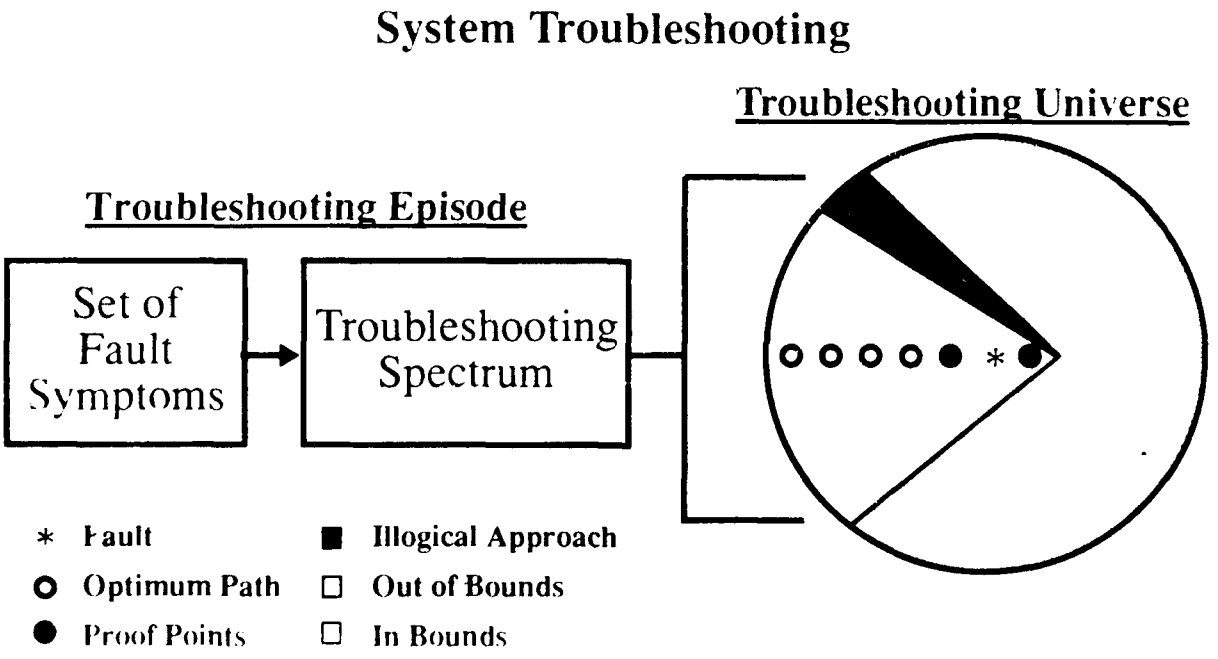

Figure 2. TAE Factors Model.

Research Subject Groups

The test and evaluation plan specified three different subject groups. The groups were identified as novice, experienced, and expert. Within the novice group, two sets of individuals should show similar performance scores: (1) "C" school students (at end of course) and (2) apprentice/inexperienced individuals that have graduated from "C" school and held a NEC ET-1453 rating for less than one year. Individuals with less than one year experience are considered novices since fleet personnel do not have sufficient opportunity to work on their specific system to become "experienced" until they have been aboard ship for a year or more. Journeymen/ experienced personnel are defined as individuals who hold a NEC ET-1453, are currently assigned to a ship with NAVMACS system ET-1453 billets, and have been working for more than one year (on their specific system). Masters/experts are defined as individuals who hold a NEC ET-1453 and have one year or more of experience working at a special technical assignment such as a Mobile Technical Unit (MOTU) or as a technical representative at a comparable project office. An expert could be a school instructor, a NAVMACS MOTU representative, or project office engineering/technical support military staff member for NAVMACS(V)/SATCOM system

Research Objectives

The purpose of the test and evaluation was to provide information on the reliability and validity of the TAE demonstration to discriminate between levels of troubleshooting proficiency. To establish the objectives of the test and evaluation, it is necessary to define the terms reliability and validity within the TAE context.

Reliability concerns the problem of errors in measurement. For TAE, the focus is on whether an individual's scores are consistent across TAE episodes and whether the scores on TAE episodes are consistent across individuals.

The general concept of validity revolves around the question, "Does an instrument perform the function it is intended to perform?" For TAE, the question is "Does TAE discriminate between different levels of troubleshooting proficiency?" Validity is usually a matter of degree as opposed to an all or nothing property. There are three types of validity to investigate within the context of the TAE test and evaluation: (1) empirical validity, (2) content validity, and (3) construct validity.

Empirical validity may be defined in terms of predictive and concurrent validity. Predictive validity is concerned with the ability of a test to predict performance in the future, while concurrent validity is concerned with the relationship between the test and a contemporary measure of performance (Conner, 1987). For TAE, concurrent validity may be addressed by evaluating TAE performance against "C" school performance, supervisor ratings, and similar measures.

Predictive validity refers to the ability of an instrument to estimate some behavior, known as the criterion. For TAE, the criterion of interest is troubleshooting proficiency. However, an "ultimate" criterion measure of troubleshooting proficiency may not exist. In a review of reports investigating the prediction of job performance of military enlisted personnel, Vineberg and Joyner (1982) concluded that performance in training is currently the best predictor of job proficiency (measured by job knowledge tests) and job performance (measured by supervisor ratings).

The test and evaluation plan proposed use of fleet subject matter experts and instructor ratings of TAE scoring profiles to construct a troubleshooting proficiency criterion. This measure can be refined over time to produce a closer approximation of the ultimate criterion of troubleshooting proficiency. If the concepts of content and construct validity are established, it should be possible to build a strong logical connection between TAE and its ability to predict troubleshooting proficiency of electronics technicians in the fleet.

Content validity is concerned with the question, "Does the instrument adequately sample a particular domain?" Content validity addresses the representativeness of the content of the test and the manner in which it is presented as opposed to empirical validity (Nunnally & Durham, 1975). Issues of content validity were incorporated into the selection of problems for TAE as well as the design of the TAE episodes. A representative sample of faults was identified based on expert opinion and maintenance information available on the NAVMACS(V)/SATCOM system.

Construct validity focuses on whether the content domain has been adequately sampled and developed into testing measures (Nunnally & Durham, 1975). The three essentials for creating and validating a construct measure are to: (1) outline the domain of observables, (2) find out which and how much the different observables relate with each other or are affected similarly by experimental treatments, and (3) find out whether one or more of the observable variables measures the construct (Nunnally & Durham, 1975).

Troubleshooting proficiency is viewed as a multifaceted attribute realized through a variety of perceptual, cognitive, and motor behaviors. The domain of observable measures for troubleshooting proficiency encompasses descriptive measures such as product and process; prescriptive measures such as cognitive ability, aptitude, and cognitive style; and performance dimensions such as time, errors, and inefficient actions (Conner, 1987). Currently, the ten troubleshooting evaluation factors represent the domain of observable measures for TAE.

Empirical tests can determine which troubleshooting measures correlate with each other or are similarly affected alike by TAE treatments. The measures that respond similarly and consistently for the different treatments hold the most construct validity. The TAE test and evaluation plan was designed to investigate whether the troubleshooting factors respond in a similar and consistent manner in the different TAE episodes. Another test of construct validity is whether the measures of the construct behave as expected. Many of the research hypotheses in this effort relate to the construct validity of TAE. Taken together, they serve as the validation of TAE as a measurement of troubleshooting proficiency.

METHOD

Research Hypotheses

The research hypotheses for the TAE test and evaluation are organized into seven categories: (1) experience, (2) electronics knowledge, (3) electronics performance proficiency, (4) difficulty level, (5) time, (6) complex test equipment, and (7) ranking. The hypotheses in each category are described below.

Experience (Hypotheses 1 through 3)

Previous research has noted that experience is positively correlated with troubleshooting proficiency (Morris & Rouse, 1985). The TAE subjects are organized into three experience levels (novice, experienced, expert). The following hypotheses were designed to test whether the TAE episodes discriminated between troubleshooting proficiency by the experience levels of subjects.

1. Instructors (experts/masters) will score significantly higher on the TAE test than students (novices/apprentices).

2. Experienced fleet personnel journeymen will score significantly higher on the TAE test than students (novices).

3. Subjects with a longer time in the electronics rate (i.e., time-in-service [TIS]) experience will score significantly higher on the TAE test than subjects with less time in that rate (inexperienced).

Hypothesis 1 was tested using a one-way analysis of variance (ANOVA) that compared the group means of the TAE test scores for instructors vs. students. No data were available for experienced fleet personnel so hypothesis 2 was dropped from the analysis. Hypothesis 3 was tested using correlational analyses. The following data were required to test each hypothesis:

1. AE student scores and TAE instructor scores.

3. TAE student scores, TAE instructor scores, and time in service (TIS) for all subjects.

Electronics Knowledge (Hypotheses 4 through 6)

The following hypotheses were designed to test the concurrent validity as well as the construct validity of the TAE episodes (in this case, the relationship between electronics knowledge and TAE performance).

4. Students (novices) with higher academic "C" school final scores will score higher on the TAE test than students (novices) with lower scores.

5. Students (novices) with higher academic "C" school subsystem test scores will score higher on the TAE subsystem tests (episodes) than students (novices) with lower "C" school subsystem test scores.

6. Subjects with higher appropriate Armed Services Vocational Battery (ASVAB) scores: that is, Electronic Information (EI) and Electronics Technician selection scores (General Science [GS] + Electronics Information [EI] + Mathematics Knowledge [MK]; plus Arithmetic Reasoning [AR] and Armed Forces Qualification Test [AFQT]) will score higher on the TAE test than subjects with lower ASVAB and selection scores.

Hypotheses 4 through 6 were tested using correlational analyses. The following data were required to test each hypothesis:

4. TAE student scores, "C" school final scores, and "C" school comprehensive scores.

5. TAE student subsystem scores and "C" school subsystem scores.

6. TAE student scores and ASVAB AFQT, GS, EI, MK, and AR scores.

Electronics Performance Proficiency (Hypotheses 7 through 12)

Previous research has indicated that technical knowledge or practical job knowledge is related to troubleshooting performance (Morris & Rouse, 1985). The following hypotheses were designed to test the construct validity of the TAE episodes in discriminating between troubleshooting proficiency levels (in this case, the relationship between specific electronics troubleshooting behavior and TAE performance).

7. Subjects with a higher level of troubleshooting proficiency will make fewer invalid checks than less proficient subjects.

8. Subjects with a higher level of troubleshooting proficiency will make fewer illogical approaches than less proficient subjects.

9. Subjects with a higher level of troubleshooting proficiency will make fewer incorrect solutions than less proficient subjects.

10. Subjects with a higher level of troubleshooting proficiency will make fewer redundant checks than less proficient subjects.

11. Subjects with a higher level of troubleshooting proficiency will test significantly more proof points than less proficient subjects.

12. In general, subjects with a higher level of troubleshooting proficiency will make significantly fewer tests than less proficient subjects.

Hypotheses 7 through 12 were tested using correlational analyses. The following data were required to test each hypotheses:

7. TAE student scores, TAE instructor scores, and the number of invalid checks.

8. TAE student scores, TAE instructor scores, and the number of illogical approaches.

9. TAE student scores, TAE instructor scores, and the number of incorrect solutions.

10. TAE student scores, TAE instructor scores, and the number of redundant checks.

11. TAE student scores, TAE instructor scores, and the number of proof points.

12. TAE student scores, TAE instructor scores, and the number of the following types of tests: test points, equipment selection events, front panel events, maintenance panel events, fallback test events, review symptoms events, diagnostic test events, load operational

program events, step procedure events, revision events, total number of steps taken in the episode.

Difficulty Level (Hypotheses 13 through 16)

It seems reasonable to assume that increasing troubleshooting task difficulty will increase the time expended (as well as other factors, even though only time will be investigated here) in finding the solution. The length of time to solution may also be affected by the subject's troubleshooting proficiency level. The following hypotheses were designed to test the reliability of the TAE episodes as well as their ability to discriminate between troubleshooting proficiency levels (in this case, the relationship between the difficulty of troubleshooting episodes and TAE perform-ance.

13. The more difficult the episode, the longer the average time needed to find the solution across subjects.

14. On episodes of equal difficulty, subjects with a higher level of troubleshooting proficiency will take significantly less time than less proficient subjects in finding the solution.

15. The more difficult the episode, the less time the instructors (experts) will take to find the TAE test solutions when compared to the students (novices).

16. The more difficult the episode, the less time the experienced fleet personnel will take to find the TAE test solutions when compared to the students (novices).

Hypotheses 13 through 15 were tested using correlational analyses. No data were available for experienced fleet personnel so hypothesis 16 was dropped from the analysis. The following data were required to test each hypothesis:

13. TAE difficulty level z scores for each episode and length of time to find solution for each subject. To find z scores, 30 selected TAE variables were summed across all subjects for each episode. The 14 separate episode totals were then transformed into z scores using the Microstat Statistical Package.[1]

14. TAE student scores, TAE instructor scores, TAE difficulty level z scores for each episode and length of time to find solution for each subject.

15. TAE student scores, TAE instructor scores, length of time to find solution for each subject, difference between average student time to find solution and average instructor time to find solution, and TAE difficulty level z scores for each episode.

Time (Hypotheses 17 and 18)

The following hypotheses were designed to validate the ability of the TAE episodes to evaluate and diagnose troubleshooting proficiency (in this case, to test the relationship between time and the TAE episode results). Subject matter experts noted that good troubleshooters often

[1]Identification of specific equipment and software is for documentation only and does not imply endorsement.

will take a longer period of time to make the first test of equipment. This observation seems related to previous research concerning cognitive styles and troubleshooting where it was noted that subjects with a reflective vs. an impulsive cognitive style made fewer errors in troubleshooting tasks (Morris & Rouse, 1985). It may be that a good troubleshooter begins by surveying the state of the equipment to generate hypotheses about the possible fault, uses the test to collect information, and then takes a longer amount of time to integrate the information discovered to generate solutions to the problem.

17. Subjects with a higher level of troubleshooting proficiency will take significantly less total time to find TAE episode solutions than less proficient subjects.

18. In general, subjects with a higher level of troubleshooting proficiency will take a significantly longer time than less proficient subjects before making the first test point.

Hypotheses 17 and 18 were tested using correlational analyses. The following data were required to test the hypothesis:

17. TAE student scores, TAE instructor scores, and total time.

18. TAE student scores, TAE instructor scores, time to first reference designator test, and time to first diagnostic test.

Complex Test Equipment (Hypothesis 19)

The following hypothesis was designed to test the construct validity of the TAE episodes (in this case, to test the relationship between the use of complex test equipment and TAE performance). Previous research has noted that good troubleshooters tend to make more difficult checks than do poor troubleshooters (Morris & Rouse, 1985). It would seem reasonable to state that good troubleshooters will use more complex test equipment.

19. Subjects with a higher level of troubleshooting proficiency will make significantly more tests using an oscilloscope than less proficient subjects.

Hypothesis 19 was tested using correlational analyses. The following data were required: TAE student scores, TAE instructor scores, and the number of oscilloscope (waveform) tests.

Ranking (Hypotheses 20 through 22)

The following hypotheses were designed to test both the concurrent and the construct validity of the TAE episodes (in this case, the relationship between student rankings and performance indicators). It seems reasonable to assume that, if the TAE test reflects an individual's troubleshooting proficiency, there will be a positive relationship between the student's TAE class ranking, instructor rankings, and "C" school course ranking.

20. The higher the student's TAE class rank, the higher the student will be ranked in terms of troubleshooting proficiency by instructors/work center supervisors.

21. The higher the student's TAE class rank, the higher the student's ranking in the class.

22. The higher the instructor ranking of the student in terms of troubleshooting proficiency, the higher the student's ranking in the class.

Hypotheses 20 through 22 were tested using correlational analyses. The following data were required to test each hypothesis:

20. Student TAE class ranking and instructor ranking of student troubleshooting proficiency.

21 Student TAE class ranking and course class student ranking.

22. Instructor ranking of student troubleshooting proficiency and class course student ranking.

Test Administration Procedure

Test administration was conducted by Navy Personnel Research and Development Center (NPRDC) personnel in a quiet classroom environment at the Advanced Electronics Schools Department (AESD), Service Schools Command, San Diego, California. The TAE test was administered on the Zenith 248 microcomputer. The test was completed using technical documentation for the NAVMACS(V)/SATCOM (NEC ET-1453) system. All technical documentation was within the reach of the subject during testing.

The test administrator assigned the subjects to one of two randomized test sequences to protect the TAE study from test order effects. A total of 16 episodes, including two practice episodes, were administered to each subject:

1.	AN/USH-26	Formatter A
2.	AN/USH-26	Formatter B
3.	AN/USQ-69	Power Supply
4.	AN/USQ-69	CRT
5.	AN/VYK-20	Micro Channel 15 and IO Oneshot Control
6.	AN/VYK-20	Channel 14 Interface
7.	CV-3333	Sample Processor Assembly
8.	CV-3333	Sample Data Generator Assembly
9.	ON-143	Transmit Sequence Control
10.	ON-143	Relay Card
11.	RD-397	Punch Enable Signal
12.	RD-397	LDR Signal
13.	TT-624	Input and Buffer Data Registers
14.	TT-624	Paper Feed Control Logic
15.	TT-624	Hammer Drivers (Practice)
16.	AN/USH-26	Parallel Interface (Practice)

Each episode required approximately one hour (or less) to complete, although there was no specific time limit. The subjects completed all 16 episodes in two to three days. The test administrator was in the classroom continuously to brief subjects and set up the programs.

Testing began with a brief introduction to the TAE study and the technical documentation available. The subjects read and signed a Privacy Act release statement. The test administrator started subjects off by entering their social security number. The subjects began with a Learn Program, followed by two practice episodes to become familiar with the TAE test displays and menus. After testing was completed, the subjects were given test performance feedback.

Subjects

The TAE test and evaluation plan was designed to assess the troubleshooting proficiency of three personnel groups within the Navy electronics training and shipboard environments: (1) "C" school students, (2) fleet personnel, and (3) personnel designated as having special assignments. The students were individuals enrolled in "C" school during the "system" phase of the course. The fleet personnel were individuals who had graduated from "C" school, held an NEC ET-1453, and had varying amounts of experience. The special assignment personnel were "C" school instructors who taught and managed training in the electronics classes or were personnel assigned to a Mobile Technical Unit (MOTU) or other technical assignments dealing with the NAVMACS(V) SATCOM.

All TAE subjects were required to have "C" school training on the NAVMACS(V)/ SATCOM subsystems. For students enrolled in "C" school, the tests were administered in the last two weeks of training during the system phase of the course. The projected number of subjects for the TAE test and evaluation was approximately 100 students (50 each from San Diego and Norfolk), 50 instructors and 50 fleet personnel (25 each from each coast).

Data Collection

In the final results, data were collected for 53 students and 13 instructors, all at AESD, San Diego. According to the original design, student and instructor data were also going to be collected at Fleet Training Center, Norfolk and from fleet personnel from both coasts. However, due to funding cuts, it was not possible to gather data on students or instructors in Norfolk or fleet personnel on either coast. As a consequence, Hypotheses 2 and 16 were dropped from the study since no fleet personnel data were available. In other hypotheses dealing with time or experience, the instructor data were used to evaluate the hypotheses.

Data for two separate data bases were collected by NPRDC. The first data base contained demographic data and the second contained TAE program performance data. Both demographic and TAE performance data were collected for seven classes of "C" school students between April and September 1989. All student data were organized by "C" school class number. The demographic data for each student included: Social Security Number, time in service, ASVAB scores, "C" school subsystem final scores, "C" school comprehensive score, "C" school final score, class ranking, TAE ranking, and instructor ranking. Demographic and TAE performance data for the instructors were collected during September 1989. The demographic data for each instructor included Social Security Number, rate/rating, time in service, time in paygrade, length of time holding NEC ET-1453, length of time working on the NAVMACS(V)/SATCOM system in the fleet, and length of time as a NAVMACS(V)/SATCOM instructor. The TAE program data for both students and instructors consisted of scores for 16 episodes encompassing 673 variables. Thus, each subject, whether student or instructor, received 673 separate scores. Table 2 presents

the variables for each case. Table 3 describes the variables for each episode (Episode 1 is presented).

As the demographic data and TAE performance data were collected by NPRDC, two separate data bases were built using the Microstat (R) statistical package. The TAE performance data base included all of the data collected for students and instructors. The data in the data base were refined before files were created for performing preliminary evaluation of data. First, the data for the practice problems were dropped, since they would not be used for any of the analyses. Next, descriptive statistics (mean, standard deviation, minimum, maximum) were calculated. Then, based on the descriptive statistics, data were dropped for variables that had scores of zero or standard deviations of zero across all students and instructors.

Based on this refined data, a preliminary evaluation of data was performed. The evaluation included: (1) inspecting univariate descriptive statistics for accuracy of input, (2) evaluating number and distribution of missing data, (3) identifying and dealing with outliers, (3) identifying and dealing with skewness, (4) identifying and dealing with nonlinearity and heteroscedasticity, and (5) evaluating variables for multicollinearity. Based on this preliminary evaluation, the data of five students were dropped due to missing data. The data of two instructors were also dropped because they did not hold NEC ET-1453. Thus, the data of 59 subjects were used for this study, 48 students and 11 instructors.

After preliminary data evaluation and deletion of the aforementioned student and instructor data, the resultant data base was used to create files for testing the study hypotheses. From this refined data base, a matrix file was created with all the variables required to test all of the study hypotheses. The matrix (Figure 3) provides an overview of the data requirements for the study hypotheses. The matrix file was used to create other files with only those variables specifically required to test each hypothesis.

Table 2

Description of TAE Variables for Each Case

Episode																
1	2	3	4	5	6	7	8	9	10	11	12	13	14			
USH26		USQ69		UYK20		CV3333		ON143		RD397		TT624		PRACTICE		
V2	44	86	128	170	212	254	296	338	380	422	464	506	548	590	632	Equipment (hardware subsystem
V3	45	87	129	171	213	255	297	339	381	423	465	507	549	591	633	Episode number
V4	46	88	130	172	214	256	298	340	382	424	466	508	550	592	634	Found Solution
V5	47	89	131	173	215	257	299	341	383	425	467	509	551	593	635	Test Points
V6	48	90	132	174	216	258	300	342	384	426	468	510	552	594	636	Out-of-Bounds
V7	49	91	133	175	217	259	301	343	385	427	469	511	553	595	637	Valid Checks
V8	50	92	134	176	218	260	302	344	386	428	470	512	554	596	638	Invalid Checks
V9	51	93	135	177	219	261	303	345	387	429	471	513	555	597	639	Redundant Checks
V10	52	94	136	178	220	262	304	46	388	430	472	514	556	598	640	Proof Points
V11	53	95	137	179	221	263	305	347	389	431	473	515	557	599	641	Total PPs Episode
V12	54	96	138	180	222	264	306	348	390	432	474	516	558	600	642	Percentage PPs
V13	55	97	139	181	223	265	307	349	391	433	475	517	559	601	643	Total Time
V14	56	98	140	182	224	266	308	350	392	434	476	518	560	602	644	TBD
V15	57	99	141	183	225	267	309	351	393	435	477	519	561	603	645	Equip Select Events
V16	58	100	142	184	226	268	310	352	394	36	478	520	562	604	646	Front Panel Events
V17	59	101	143	185	227	269	311	353	395	437	479	521	563	605	647	Maint Panel Events
V18	60	102	144	186	228	270	312	354	396	438	480	522	564	606	648	Fallback Events
V19	61	103	145	187	229	271	313	355	397	439	481	523	565	607	649	Ref Desig Tests
V20	62	104	146	188	230	272	314	356	398	440	482	524	566	608	650	Replace LRU Events
V21	63	105	147	189	231	273	315	357	399	441	483	525	567	609	651	Review Symp Events
V22	64	106	148	190	232	274	316	358	400	442	484	526	568	610	652	TBD
V23	65	107	149	191	233	275	317	359	401	443	485	527	569	611	653	Diag Test Events
V24	66	108	150	192	234	276	318	360	402	444	486	528	570	612	654	Load Op Prgm Events
V25	67	109	151	193	235	277	319	361	403	445	487	529	571	613	655	Step Proced Events
V26	68	110	152	194	236	278	320	362	404	446	488	530	572	614	656	Revision Events
V27	69	111	153	195	237	279	321	363	405	447	489	531	573	615	657	INC Rep LRU Events

TBD = To be determined

Table 2 (Continued)

Episode																
1	2	3	4	5	6	7	8	9	10	11	12	13	14			
USH26		USQ69		UYK20		CV3333		ON143		RD397		TT624		PRACTICE		
V28	70	112	154	196	38	280	322	364	406	448	490	532	574	616	658	Good Fault Rep LRU Events
V29	71	113	155	197	239	281	323	365	407	449	491	533	575	617	659	Time to 1st Ref Design Tests
V30	72	114	156	198	240	282	324	366	408	450	492	534	576	618	660	Time to 1st Diag Test
V31	73	115	157	199	241	283	325	367	409	451	493	535	577	619	661	Total Steps
V32	74	116	158	200	242	284	326	368	410	452	494	536	578	620	662	Waveform Tests
V33	75	117	159	201	243	285	327	369	411	453	495	537	579	621	663	Voltage Tests
V34	76	118	160	202	244	286	328	370	412	454	496	538	580	622	664	Read Meter Tests
V35	77	119	161	203	245	287	329	371	413	455	497	539	581	623	665	Logic Tests
V36	78	120	162	204	246	288	330	372	414	456	498	540	582	624	666	Current Tests
V37	79	121	163	205	247	289	331	373	415	457	499	541	583	625	667	Frequency Tests
V38	80	122	164	206	248	290	332	374	416	458	500	542	584	626	668	Continuity Tests
V39	81	123	165	207	249	291	333	375	417	459	501	543	585	627	669	Adjustment Tests
V40	82	124	166	208	250	292	334	376	418	460	502	544	586	628	670	Final Score
V41	83	125	167	209	251	293	335	377	419	461	503	545	587	629	671	TBD
V42	84	126	168	210	252	294	336	378	420	462	504	546	588	630	672	TBD
V43	85	127	169	211	253	295	337	379	421	463	505	547	589	631	673	TBD

TBD = To be determined.

Table 3

Variables for a TAE Episode

Variable Name	Contents of Variable
V1	Subject's Social Security Number
V2	Equipment (hardware subsystem) number (1 = USH26)
V3	Episode number (1)
V4	Found Solution (1 = Yes, 0 = No)
V5	Number of Test Points
V6	Number of Out of Bounds tests
V7	Number of Valid Checks
V8	Number of Invalid Checks
V9	Number of Redundant Checks
V10	Number of Proof Points subject tested
V11	Total number of Proof Points in the episode
V12	Percentage of proof points tested: (V10 % V11) * 100, rounded to a whole number
V13	Total Time spent on the episode (in minutes)
V14	TBD
V15	Number of Equipment Selection events
V16	Number of Front Panel events
V17	Number of Maintenance Panel events
V18	Number of Fallback test events
V19	Number of Reference Designator test events
V20	Number of Replace LRU events
V21	Number of Review Symptoms events
V22	TBD
V23	Number of Diagnostic Test events
V24	Number of Load Operational Program events
V25	Number of Step Procedure events
V26	Number of Revision events
V27	Number of INCORRECT Replace LRU events
V28	Number of GOOD FAULT Replace LRU events
V29	Time to first Reference Designator Test (in minutes)
V30	Time to first Diagnostic Test (in minutes)
V31	Total number of steps taken in the episode: ALL events, (even "login" and "logout") except "revision" events, which are created when episode data is edited by an instructor.
V32	Number of Waveform tests performed
V33	Number of Voltage tests performed
V34	Number of Read Meter tests performed
V35	Number of Logic tests performed
V36	Number of Current tests performed
V37	Number of Frequency tests performed
V38	Number of Continuity tests performed
V39	Number of Adjustment tests performed
V40	Final Score of the episode
V41, V42, V43	TBD -- these are for possible future expansion

TBD = To be determined.

FIGURE 3. MATRIX OF DATA REQUIRED FOR HYPOTHESES TESTING

HYPOTHESES	VARIABLES																																
	TAE_S	TAE_I	$TIS_{S/I}$	SKL_F	SKL_C	TAE_{SSS}	SKL_{SSS}	$ASVAB_{AFQT}$	$ASVAB_{CS}$	$ASVAB_{AR}$	$ASVAB_{MK}$	$ASVAB_{EI}$	$ASVAB_I$	$ASVAB_T$	INV	ILL	INCS	RED	PP	Tests	TAE Diff	Time	TAE Diff$_{Q}$	Time$_{Q\,1234}$	Time$_S$	Time$_I$	Time$_{1st}$	OSC Test	TAE Rank	Class Rank	Inst Rank
1. TAE_S vs TAE_I	•	•																															
3. $TAE_{S/I}$ vs $TIS_{S/I}$	•	•	•																														
4. TAE_S vs SKL_F	•			•																													
TAE_S vs SKL_C	•				•																												
5. TAE_{SSS} vs SKL_{SSS}						•	•																										
6. TAE_S vs $ASVAB_{AFQT}$	•							•																									
TAE_S vs $ASVAB_{CS}$	•								•																								
TAE_S vs $ASVAB_{AR}$	•									•																							
TAE_S vs $ASVAB_{MK}$	•										•																						
TAE_S vs $ASVAB_{EI}$	•											•																					
TAE_S vs $ASVAB_I$	•												•																				
TAE_S vs $ASVAB_T$	•													•																				
7. $TAE_{S/I}$ vs INV	•	•													•																			
8. $TAE_{S/I}$ vs ILL	•	•														•																		
9. $TAE_{S/I}$ vs INCS	•	•															•																	
10. $TAE_{S/I}$ vs RED	•	•																•																
11. $TAE_{S/I}$ vs PP	•	•																	•															
12. $TAE_{S/I}$ vs Tests	•	•																		•														
13. TAE Diff vs Time	•	•																			•	•												
14. TAE $Diff_Q$ vs $Time_Q$	•	•																					•	•										
15. $Time_S$ - $Time_I$ vs TAE Diff	•	•																			•				•	•								
17. $TAE_{S/I}$ vs Time	•	•																				•												
18. $TAE_{S/I}$ vs $Time_{1st}$	•	•																									•							
19. $TAE_{S/I}$ vs OSC Test	•	•																										•						
20. TAE Rank vs Inst Rank																													•		•			
21. TAE Rank vs Class Rank																													•	•				
22. Inst Rank vs Class Rank																														•	•			

LEGEND FOR FIGURE 3

TAE_S	Average score across TAE episodes per student.
TAE_I	Average score across TAE episodes per instructor.
$TAE_{S/I}$	Average score across TAE episodes per student and instructor.
TIS	Time In Service.
SKL_F	"C" school final score per student.
SKL_C	"C" school comprehensive score per student.
TAE_{SSS}	Average subsystem score across TAE episodes per student.
SKL_{SSS}	"C" school subsystem score per student.
$ASVAB_{AFQT}$	ASVAB Armed Forces Qualification Test score per student.
$ASVAB_{GS}$	ASVAB General Science Test score per student.
$ASVAB_{AR}$	ASVAB Arithmetic Reasoning Test score per student.
$ASVAB_{MK}$	ASVAB Mathematical Knowledge Test score per student.
$ASVAB_{EI}$	ASVAB Electronic Information Test score per student.
$ASVAB_1$	ASVAB GS + MK + EI Test scores per student.
$ASVAB_1$	$ASVAB_1$ + AR Test score per student.
INV	Total number of invalid checks per subject. An invalid check is when a subject uses an inappropriate piece of test equipment at a test point.
ILL	Total number of illogical approaches per subject. An illogical approach indicates an inappropriate equipment selection occurred.
INCS	Total number of times the subject replaced a Lowest Replaceable Unit (LRU) incorrectly and it was not the fault.
RED	Total number of same test types made consecutively at the same test point.
PP	Total number of proof points tested. A proof point is a test point that positively identifies an LRU as faulted.
Tests	Overall average for each subject for the following tests: test points, equipment selection events, front panel events, maintenance panel events, fallback test events, review symptoms events, diagnostic test events, load operational program events, step procedure events, revision events, and total number of steps taken in the episode.
TAE Diff	Z scores of difficulty level for each TAE episode.
Time	Length of time to find solution for each subject.
$TAE\ Diff_{G12345}$	Groupings of episodes into difficulty levels based on episode Z scores.
$Time_{G12345}$	Length of time to find solution for each difficulty level grouping.
$Time_S$	Average length of time to find solution for each episode across students.
$Time_I$	Average Length of time to find solution for each episode across instructors.
$Time_{1st}$	Combined average for each subject of time till first reference designator test and time till first diagnostic test.
OSC Test	Average number of oscilloscope tests per subject across episodes.
TAE Rank	Class ranking of students based on TAE scores.
Inst Rank	Instructor ranking of student TS proficiency by class.
Class Inst	Student course ranking by class.

RESULTS

Demographic Data

Demographic data were collected for 53 students and 13 instructors. Due to missing data, five of the students were dropped from the data base For the remaining 48 students, the average time in service was 2.23 years. The data for two of the instructors were dropped because they did not hold NEC ET-1453. For the remaining 11 instructors, 9 had a rate of ET1 and 2 had a rate of ET2; the average paygrade was 5.82. The average time in service for instructors was 10.41 years and average time in paygrade was 3.64 years. The instructors had held NEC ET-1453 for an average of 4.67 years and had worked on the NAVMACS(V)/SATCOM hardware in the fleet an average of 2.94 years. In addition, they averaged 16.18 months as NAVMACS(V)/SATCOM instructors. For complete listings of student and instructor demographic data, see Appendix A. See Appendix B for complete hypotheses testing data.

Experience (Hypotheses 1 and 3)

Hypothesis 1 is stated as follows: Instructors (experts) will score significantly higher on the TAE test than students (novices). A one way analysis of variance (ANOVA) was performed to test this hypothesis. As shown in Table 4, the F ratio value is 2.271 with a probability of.1373, which is not significant. Thus, the instructors did not score significantly higher on the TAE test than students.

Table 4

ANOVA for Student TAE Final Scores vs. Instructor TAE Final Scores

GROUP	MEAN	N			
Students	70.396	48			
Instructors	73.422	11			
GRAND MEAN	70.960	59			
SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F RATIO	PROB.
BETWEEN	81.973	1	81.973	2.271	.1373
WITHIN	2057.124	57	36.090		
TOTAL	2139.098	58			

Hypothesis 3 is stated as follows: Subjects with a longer time in the electronics rate (i.e., TIS) will score significantly higher on the TAE test than subjects with less time in that rate. As shown in Table 5, the correlation between time in electronics rate and TAE score is 13.68, which is not significant. Therefore, subjects with a longer time in the electronics rate did not score significantly higher on the TAE test than subjects with less time in that rate.

Table 5

Correlation Matrix: TIS vs. TAE Final Scores
(N = 59)

	TIS	TAE SCORE
TIS	1.00000	
TAE SCORE	.13676	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Electronics Knowledge (Hypotheses 4 through 6)

Hypothesis 4 is stated as follows: Students (novices) with higher academic "C" school final scores will score higher on the TAE test than students (novices) with lower scores. As shown in Table 6, the correlation between academic "C" school final scores (over course final score) and TAE test scores is .302, which is significant at the .05 significance level. Thus, there was a significant positive correlation between academic "C" school final scores and TAE test scores. On the other hand, as shown in Table 7, the correlation between academic "C" school comprehensive scores (final test) and TAE test scores is .173, which is a positive correlation but not significant. Therefore, academic "C" school final scores were significantly correlated with TAE test scores, but "C" school comprehensive scores were not.

Table 6

Correlation Matrix: "C" School Final Scores vs. TAE Final Scores
(N = 48)

	FINAL SCORE	TAE SCORE
FINAL SCORE	1.00000	
TAE SCORE	.30181	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .24045.

Table 7

Correlation Matrix: "C" School Comprehensive Scores vs. TAE Final Scores (N = 48)

	COMPREHENSIVE SCORE	TAE SCORE
COMPREHENSIVE SCORE	1.00000	
TAE SCORE	.17311	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .24045.

Hypothesis 5 is stated as follows: Students (novices) with higher academic "C" school subsystem test scores will score higher on the TAE subsystem tests (episodes) than students (novices) with lower "C" school subsystem test scores. Each subsystem includes the following equipment: Subsystem 1 = UYK20; Subsystem 2 = USH26, USQ69, RD397, TT624; Subsystem 3 = CV3333; Subsystem 4 = ON143.

Table 8 summarizes the results of the correlational analyses. Complete correlational matrices for each subsystem are presented in Appendix B. For Subsystem 1, the correlation of academic "C" school subsystem test scores with TAE subsystem test scores is .277, which is significant at the .05 level. Subsystem 2 has a correlation of .176, which is not significant. Both Subsystems 3 and 4 have negative correlations of -.181 and -.220 respectively, which are not significant. Therefore, the only significant correlation between academic "C" school subsystem test scores and TAE subsystem test scores was for Subsystem 1, the UYK20.

Table 8

Correlation Between "C" School Subsystem Test Scores and TAE Subsystem Test Scores (N = 48)

PREDICTOR	CORRELATION WITH SCHOOL FINAL
TAE Average Score Subsystem 1	.277 *
TAE Average Score Subsystem 2	.176
TAE Average Score Subsystem 3	-.181
TAE Average Score Subsystem 4	-.220

*$p < .05$.

Hypothesis 6 is stated as follows: Students with higher appropriate ASVAB; that is, EI and ET selection criteria scores (GS+EI+MK; plus AR and AFQT) will score higher on the TAE test than subjects with lower ASVAB and selection scores. Table 9 summarizes the results of the correlational analyses between ASVAB selection criteria scores and TAE test scores. Complete correlational matrices for ASVAB scores are presented in Appendix B.

As shown in Table 9, all but one of the correlations is negative. The only significant correlation between ASVAB scores and TAE score is Arithmetic Reasoning (AR) with a negative correlation of -.325, significant at the .05 level. The only positive correlation is between General Science (GS) and TAE score, with a non-significant correlation of .115.

Table 9

Correlation Between ASVAB Selection Criteria Scores and TAE Test Scores (N = 48)

ASVAB SCORE	CORRELATION WITH TAE TEST SCORES
AFQT	-.004
GS	.115
AR	-.325*
MK	-.101
EI	-.067
GS + MK + EI (ASVAB 1)	-.027
GS + MK + EI (ASVAB T)	-.131

*p < .05.

Electronics Performance Proficiency (Hypotheses 7 through 12)

Hypothesis 7 is stated as follows: Subjects with a higher level of troubleshooting proficiency will make fewer invalid checks than less proficient subjects. As shown in Table 10, the correlation between TAE score and the number of invalid checks is -.171, which is not significant. Therefore, subjects with higher troubleshooting proficiency tended to make fewer invalid checks than less proficient subjects.

Table 10

Correlation Matrix: TAE Score vs. Invalid Checks (N = 59)

	TAE SCORE	INVALID CHECKS
TAE SCORE	1.00000	
INVALID CHECKS	-.17107	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Hypothesis 8 is stated as follows: Subjects with a higher level of troubleshooting proficiency will make fewer illogical approaches than less proficient subjects. As shown in Table 11, the correlation between TAE score and the number of illogical approaches is -.341, which is significant

at the .01 level. Therefore, subjects with higher troubleshooting proficiency made significantly fewer illogical approaches than less proficient subjects.

Table 11

Correlation Matrix: TAE Score vs. Illogical Approaches
(N = 59)

	TAE SCORE	ILLOGICAL APPROACHES
TAE SCORE	1.00000	
ILLOGICAL APPROACHES	-.34057	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Hypothesis 9 is stated as follows: Subjects with a higher level of troubleshooting proficiency will make fewer incorrect solutions than less proficient subjects. As shown in Table 12, the correlation between the TAE score and the number of incorrect solutions is -.697, which is significant at the .001 level. Thus, subjects with higher troubleshooting proficiency made significantly fewer incorrect solutions than less proficient subjects.

Table 12

Correlation Matrix: TAE Score vs. Incorrect Solutions
(N = 59)

	TAE SCORE	INCORRECT SOLUTIONS
TAE SCORE	1.00000	
INCORRECT SOLUTIONS	-.69676	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638

Hypothesis 10 is stated as follows: Subjects with a higher level of troubleshooting proficiency will make fewer redundant checks than less proficient subjects. As shown in Table 13, the correlation between TAE score and the number of redundant checks is -.085, which is not significant. Therefore, subjects with higher troubleshooting proficiency tended to make fewer redundant checks than less proficient subjects.

Table 13

Correlation Matrix: TAE Score vs. Redundant Checks
(N = 59)

	TAE SCORE	REDUNDANT CHECKS
TAE SCORE	1.00000	
REDUNDANT CHECKS	-.08543	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Hypothesis 11 is stated as follows: Subjects with a higher level of troubleshooting proficiency will test significantly more proof points than less proficient subjects. As shown in Table 14, the correlation between the TAE score and the number of proof points is .561, which is significant at the .001 level. Therefore, subjects with higher troubleshooting proficiency tested significantly more proof points than less proficient subjects.

Table 14

Correlation Matrix: TAE Score vs. Proof Points
(N = 59)

	TAE SCORE	PROOF POINTS
TAE SCORE	1.00000	
PROOF POINTS	.56097	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Hypothesis 12 is stated as follows: In general, subjects with a higher level of troubleshooting proficiency will make significantly fewer tests than less proficient subjects. As shown in Table 15, the correlation between the level of troubleshooting proficiency and number of tests is -.552, which is significant at the .001 level. Therefore, subjects who demonstrated a higher level of troubleshooting proficiency through higher TAE scores, made significantly fewer tests than less proficient subjects.

Table 15

Correlation Matrix: TAE Score vs. Number of Tests
(N = 59)

	TAE SCORE	NUMBER TESTS
TAE SCORE	1.00000	
NUMBER TESTS	-.55201	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Difficulty Level (Hypotheses 13 through 16)

Hypothesis 13 is stated as follows: The more difficult the episode, the longer the average time needed to find the solution across subjects. As shown in Table 16, the correlation of TAE difficulty with length of time to find the solution is .931, which is significant at the .001 level. Therefore, the more difficult the episode the longer subjects took to find the solution.

Table 16

Correlation Matrix: TAE Difficulty vs. Time
(N = 14)

	AVERAGE TIME	Z SCORE
AVERAGE TIME	1.00000	
Z SCORE	.93051	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .45900

Hypothesis 14 is stated as follows: On episodes of equal difficulty, subjects with a higher level of troubleshooting proficiency will take significantly less time than less proficient subjects in finding the solution. The episodes were assigned (based on their Z scores) to difficulty levels as follows with level 1 being the easiest and level 5 the most difficult: (1) episodes 7, 8, (2) episodes 1, 2, 3, 12, (3) episodes 4, 11, 14, (4) episodes 5, 13, and (5) episodes 6, 9, 10. Table 17 summarizes the results of the correlational analysis between difficulty levels and time. Complete correlational matrices for each level are presented in Appendix B. As shown in Table 17, Hypothesis 14 was supported for each level. Therefore, for each of the difficulty levels, subjects with a higher level of troubleshooting proficiency took significantly less time than less proficient subjects in finding the solution.

Table 17

Correlation Between Difficulty Level and Time to Solution
(N = 59)

DIFFICULTY LEVEL	CORRELATION WITH TIME TO SOLUTION
Level 1	-.813 *
Level 2	-.336 **
Level 3	-.747 *
Level 4	-.736 *
Level 5	-.588*

*p < .001.
**p < .01.

Hypothesis 15 is stated as follows: The more difficult the episode, the less time the instructors will take to find the TAE test solutions when compared to the students (novices). As shown in Table 18, the difficulty level of the episode and the difference in time between instructors and students to find TAE test solutions is negatively correlated -.347, which is not significant. Although a significant difference was not found, the more difficult the episode, the less time instructors tended to take to find the TAE test solutions when compared to the students.

Table 18

Correlation Matrix: TAE Difficulty vs. Time Differences Between Students and Instructors
(N = 14)

	Z SCORE	TIME DIFFERENCE
Z SCORE	1.00000	
TIME DIFFERENCE	-.34656	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .45900.

Time (Hypotheses 17 and 18)

Hypothesis 17 is stated as follows: Subjects with a higher level of troubleshooting proficiency will take significantly less total time to find TAE episode solutions than less proficient subjects. As shown in Table 19, the correlation between TAE score and total time to find episode fault is -.492, which is significant at the .001 level. Thus, subjects with a higher level of troubleshooting proficiency took significantly less time to find episode solutions than less proficient subjects.

Table 19

Correlation Matrix: TAE Score vs. Time to Solution
(N = 59)

	TAE SCORE	TIME
TAE SCORE	1.00000	
TIME	-.49233	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Hypothesis 18 is stated as follows: In general, subjects with the higher level of troubleshooting proficiency will take a significantly longer time than less proficient subjects before making the first test point. As shown in Table 20, the correlation between TAE score and time to first test point is -.238, which is significant at the .05 level. Consequently, subjects with a higher level of troubleshooting proficiency took a significantly longer time before making the first test point than less proficient subjects.

Table 20

Correlation Matrix: TAE Score vs. Time to First Test Point
(N = 59)

	TAE SCORE	TIME TILL
TAE SCORE	1.00000	
TIME TILL	-.23814	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Complex Test Equipment (Hypothesis 19)

Hypothesis 19 is stated as follows: Subjects with a higher level of troubleshooting proficiency will make significantly more tests using an oscilloscope than less proficient subjects. As shown in Table 21, the correlation between TAE score and the number of oscilloscope tests is .168, which is not significant. Thus, subjects with higher TAE scores did not make significantly more tests using an oscilloscope than less proficient subjects.

Table 21

Correlation Matrix: TAE Score vs. Oscilloscope Tests
(N = 59)

	TAE SCORE	OSCILLOSCOPE
TAE SCORE	1.00000	
OSCILLOSCOPE	.16771	1.00000

CRITICAL VALUE (1-TAIL, .05) = +/- .21638.

Ranking (Hypotheses 20 through 22)

Hypothesis 20 is stated as follows: The higher the student's TAE class rank, the higher the student will be ranked in terms of troubleshooting proficiency by instructors/work center supervisors. The correlation values for TAE class ranking versus ranking by instructor/work center supervisor are presented in Table 22. Complete correlational matrices for each class (by graduation date) are presented in Appendix B.

Table 22

Correlation Between TAE Class Rank and Instructor Rankings

CLASS	GRADUATION DATE	CORRELATION
89030	14 APR 89	.964*
89040	12 MAY 89	.357
89060	09 JUN 89	.464
89070	07 JUL 89	.486
89080	04 AUG 89	-.143
89100	25 AUG 89	-.071
89120	29 SEP 89	.964*

*$p < .001$.

Hypothesis 20 was supported for classes 89030 and 89120 at the .001 level of significance. The correlation between TAE class ranking and instructor/work center supervisor ranking was not significant for any of the other classes. Although not significant, classes 89080 and 89100 actually indicated an inverse relationship.

Hypothesis 21 is stated as follows: The higher the student's TAE class rank, the higher the student will be ranked in the class. The correlation values for student TAE class ranking versus student ranking in "C" school classes are presented in Table 23. Complete correlational matrices for each class (by graduation date) are presented in Appendix B.

Table 23

Correlation Between TAE Class Rank and "C" School Class Rank

CLASS	GRADUATION DATE	CORRELATION
89030	14 APR 89	.893*
89040	12 MAY 89	.571
89060	09 JUN 89	-.143
89070	07 JUL 89	.486
89080	04 AUG 89	.371
89100	25 AUG 89	-.595
89120	29 SEP 89	.607

*p < .01.

Hypothesis 21 was supported for class 89030 at the .01 level of significance. For the other classes, the correlation between TAE class ranking and ranking in "C" school class was not significant. Although not significant, classes 89040 and 89120 indicated a strong positive correlation. Conversely, class 89100 showed a strong inverse relationship between TAE class ranking and "C" school class ranking.

Hypothesis 22 is stated as follows: The higher the instructor ranking of the student in terms of troubleshooting proficiency, the higher will be the student's ranking in the class. The correlation values for instructor ranking of students versus student ranking in "C" school class are presented in Table 24. Complete correlational matrices for each class (by graduation date) are presented in Appendix B.

Table 24

Correlation Between "C" School Class Rank and Instructor Ranking

CLASS	GRADUATION DATE	CORRELATION
89030	14 APR 89	.964*
89040	12 MAY 89	-.024
89060	09 JUN 89	-.357
89070	07 JUL 89	.750**
89080	04 AUG 89	.333
89100	25 AUG 89	.633**
89120	29 SEP 89	.643

*p < .001.
**p < .05.

Hypothesis 22 was supported for classes 89030, 89070, and 89100. The strongest correlation was for class 89030 (.001 level) followed by classes 89070 and 89100 (both at .05 level). Although not significant, class 89120 showed a strong positive correlation between instructor student ranking and class student ranking. For the other classes, 89080 showed a weaker positive correlation and classes 89040 and 89060 indicated an inverse relationship.

CONCLUSIONS

Experience

The results of the analyses of hypotheses 1 and 3 indicate that there was no significant relationship between experience and TAE performance. Hypothesis 2 was dropped due to the lack of data for experienced fleet personnel:

1. Instructors (experts) will score significantly higher on the TAE test than students (novices).

3. Subjects with a longer time in the electronics rate (i.e., TIS) will score significantly higher on the TAE test than subjects with less time in that rate.

Several explanations might address the apparent anomaly that there was no significant difference in the performance of the students and instructors. Instructors in the course have no requirement to have or maintain system qualification. Whereas, students must prove their system qualification or they cannot graduate or be awarded the NEC. It may, however, be argued that the evaluation technique is suspect and that these results question the validity of the TAE approach.

Electronics Knowledge

The results of the analyses of hypotheses 4 through 6 indicate that there was no generally consistent relationship between electronics knowledge and TAE performance:

4. Students (novices) with higher academic "C" school final scores will score higher on the TAE test than students (novices) with lower scores.

5. Students (novices) with higher academic "C" school subsystem test scores will score higher on the TAE subsystem tests (episodes) than students (novices) with lower "C" school subsystem test scores.

6. Students with higher appropriate Armed Services Vocational Aptitude Battery (ASVAB) (i.e., EI [Electronics Information] and ET [Electronics Technician] selection criteria scores [GS+EI+MK; plus AR and AFQT]) will score higher on the TAE test than subjects with lower ASVAB and selection scores.

Hypothesis 4 showed a relationship in which performance testing was a component of the academic school final score used. There was, however, a negative relationship between the scores used to determine selection to the occupational speciality and the performance scores. Of special note is the significant negative correlation of AR to TAE.

Electronics Performance Proficiency

As expected, the results of testing hypotheses 7 through 12 showed, generally, a consistent significant negative correlation between the hypothesis proficiency factors and TAE performance:

7. Subjects with a higher level of troubleshooting proficiency will make fewer invalid checks than less proficient subjects.

8. Subjects with a higher level of troubleshooting proficiency will make fewer illogical approaches than less proficient subjects.

9. Subjects with a higher level of troubleshooting proficiency will make fewer incorrect solutions than less proficient subjects.

10. Subjects with a higher level of troubleshooting proficiency will make fewer redundant checks than less proficient subjects.

11. Subjects with a higher level of troubleshooting proficiency will test significantly more proof points than less proficient subjects.

12. In general, subjects with a higher level of troubleshooting proficiency will make significantly fewer tests than less proficient subjects.

The only factor that failed to show significance was redundant checks. This may have been a result of the design of the delivery system (based on the design of the operational hardware) and/or the method of determining redundancy, which was seriously restricted due to programming difficulty. As a general conclusion, the results of this set of hypotheses strongly support the validity of the TAE technique and approach.

Difficulty Level

The results of testing Hypotheses 13 through 15 indicate that there was a general and consistent significant relationship between the difficulty of a troubleshooting episode and TAE performance. Hypothesis 16 was dropped due to the lack of data for experienced fleet personnel. Difficulty was defined as follows by each hypothesis:

13. The more difficult the episode, the longer the average time to find the solution across subjects.

14. On episodes of equal difficulty, subjects with a higher level of troubleshooting proficiency will take significantly less time than less proficient subjects in finding the solution.

15. The more difficult the episode, the less time the instructors will take to find the TAE test solutions when compared to the students (novices).

Generally the results regarding difficulty were as expected (i.e., more difficult, more time). At different levels of difficulty better performers took less time. An unexpected result was the lack

of significant difference between students and instructors. The difference was, however, strongly in the direction expected.

Time

As expected, there was a general and consistent significant relationship between time and the TAE episode results:

17. Subjects with a higher level of troubleshooting proficiency will take significantly less total time to find TAE episode solutions than less proficient subjects.

18 In general, subjects with the higher level of troubleshooting proficiency will take a significantly longer time than less proficient subjects before making the first test point.

The results of hypothesis 18 may indicate that an in-depth investigation of the behavior and cognitive protocols could result in a dramatic change in the way the training community presents troubleshooting training.

Complex Test Equipment

The results of the analysis indicates that there was no significant relationship between TAE performance and the use of complex test equipment:

19. Subjects with a higher level of troubleshooting proficiency will make significantly more tests using an oscilloscope than less proficient subjects.

Given the nature of the hardware system and the resulting TAE delivery system (as dictated by the maintenance philosophy of the hardware), there did not appear to be sufficient opportunity for the subjects to exercise use of complex test equipment in the TAE episodes. Therefore, the fact that there was no statistically significant result may have had no practical meaning due to the TAE design restrictions.

Ranking

Ranking was defined by the hypotheses as follows:

20. The higher the student's TAE class rank, the higher the student will be ranked in terms of troubleshooting proficiency by instructors/work center supervisors.

21 The higher the student's TAE class rank, the higher the student's ranking in the class.

22. The higher the instructor ranking of the student in terms of troubleshooting proficiency, the higher the student's ranking in the class.

There were no consistent results in rankings across instructors, TAE performance, or school performance. In fact, in several classes, inverse relationships were shown. There were, however, some classes (particularly 89030) where there was a consistent significant relationship indicated across all three hypotheses.

FUTURE EFFORTS

The following recommendations for future efforts address issues related to the results of the TAE test and evaluation. The recommendations are directed towards validity and reliability questions, as well as the modification and improvement of the TAE approach to provide a troubleshooting assessment and enhancement capability to the fleet and Navy training community.

1. Further investigate TAE as related to validity and reliability. A number of the hypotheses address the issues of validity and reliability. The method of design and development of the TAE approach and delivery system strongly supports the face validity of TAE. Subject matter experts were involved in all phases of the project. They determined the factors of evaluation; determined the weights of the factors; determined the evaluation scheme; determined the troubleshooting episodes to be used; developed the troubleshooting episodes and participated in the test and evaluation. Since the test and evaluation results are somewhat ambiguous, further investigation, particularly in those areas that deal with validity and reliability, should be conducted.

2. Further investigate TAE as related to experience and troubleshooting performance. The lack of a significant relationship between experience, as defined in this study, and troubleshooting performance, as measured by the TAE approach, causes one to consider whether the experience measures were appropriate, whether an appropriate set of subjects was tested, and whether the TAE delivery and evaluation systems is valid. Given the face validity of the TAE approach and the high level of expectation by subject matter experts of the relationship between experience and performance, it seems that further testing should be performed to resolve the apparent incongruity between these two measures.

3. Further investigate TAE as related to academic and knowledge factors. As with the results of a number of other studies of this type, there was no consistent relationship between knowledge of theory and ability to perform. This may have been related, in part, to the method of determining knowledge as academic success in the school. The method of testing in the school does not appear to provide discriminatory capability and, therefore, correlational analyses do not show statistically significant results. The schools need testing methods and techniques that provide for a true way to discriminate between student's academic and performance ability and a more structured, formalized and objective way to assess student behaviors. Otherwise, the effects of a change to instructional methods or techniques cannot be assessed in terms of relative value to the course outcomes. Then, further TAE testing could be accomplished to determine the resulting relationships.

4. Further investigate the relationships between selection requirements and troubleshooting performance. In the short term, questions arise as a result of the failure of the performance results to positively relate to the ASVAB tests used to select personnel for this occupational speciality. In fact, a consistent negative trend brings the entire screening and selection process into question. This would seem to indicate that, while the ASVAB tests may relate to academic performance, there may be no relationship between ASVAB performance, TAE performance, and/or on-the-job performance.

5. Further analyze the TAE data and results to improve the discriminatory and predictive capability of the TAE approach. The results of performance of the subjects on the TAE episodes should be subjected to behavioral protocol analyses to develop a model of troubleshooting and further analyses of good vs. bad troubleshooters. Once behavioral models are constructed, further cognitive protocol analyses could be perceived.

6. Further test the TAE approach on other subjects and on other equipment and equipment type. The TAE approach should be further investigated on hardware that allows wider and less restrictive utilization of test equipment. It may also be possible to select specific troubleshooting episodes that provide wider utilization of test equipment types. If so, it is recommended that this type of investigation take place to determine if certain episodes and hardware types require special test equipment use capability.

Also, it would be hazardous to draw major and sweeping conclusions regarding the efficacy of the current TAE system. It would be advisable to investigate this approach to other high-tech hardware systems as well as other occupational areas (i.e., mechanical hardware troubleshooters/ repair personnel). It is recommended that a TAE type delivery system be developed for a number of other high and mid-tech hardware systems.

7. Develop additional troubleshooting episodes to provide directive training, guided training, and tests with feedback. Then, a complete and comprehensive troubleshooting skill development, maintenance, assessment, and evaluation program would be available for personnel from the novice to expert skill levels. It could be used for active duty personnel in the school or fleet environment and for reserve personnel at the readiness centers or aboard ship during active duty periods.

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APPENDIX A

DEMOGRAPHIC DATA

STUDENT DEMOGRAPHIC DATA

TIME IN SERVICE (TIS) FOR STUDENTS

HEADER DATA FOR: C:TIS-STU LABEL: TIME IN SERVICE FOR STUDENTS
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 1

1	1.50
2	1.58
3	9.25
4	1.83
5	2.00
6	2.00
7	4.83
8	1.63
9	1.72
10	1.85
11	1.41
12	1.63
13	1.61
14	1.84
15	1.48
16	1.47
17	1.60
18	6.49
19	1.52
20	1.67
21	1.57
22	1.62
23	5.06
24	1.53
25	1.47
26	7.93
27	1.56
28	1.47
29	2.14
30	1.39
31	1.55
32	1.39
33	1.30
34	1.29
35	1.48
36	1.54
37	1.37
38	1.41
39	1.40
40	1.35
41	2.50
42	2.78
43	1.78
44	2.29
45	1.68
46	3.79
47	1.75
48	1.79

---------- DESCRIPTIVE STATISTICS ----------

HEADER DATA FOR: C:TIS-STU LABEL: TIME IN SERVICE FOR STUDENTS
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 1

NO.	NAME	N	MEAN	STD. DEV.	MINIMUM	MAXIMUM
1		48	2.2310	1.6934	1.2900	9.2500

DEMOGRAPHIC DATA FOR CLASS 89030 - 4/14/89 - FILE: TAEDS30

HEADER DATA FOR: C:TAEDS30 LABEL: Demographics for Class S89030
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
1	**********	1.50	74.00	62.00	58.00	62.00	44.00
2	**********	1.58	99.00	64.00	66.00	68.00	63.00
3	**********	9.25	83.00	58.00	64.00	64.00	62.00
4	**********	1.83	91.00	62.00	62.00	65.00	53.00
5	**********	2.00	72.00	60.00	55.00	52.00	55.00
6	**********	2.00	83.00	62.00	62.00	66.00	64.00
7	**********	4.83	98.00	65.00	67.00	71.00	56.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	72.00	82.00	86.70	88.00	75.00	100.00	78.00
2	70.00	90.00	86.70	96.00	85.00	100.00	92.00
3	96.00	98.00	93.30	100.00	100.00	100.00	98.00
4	74.00	92.00	86.70	84.00	100.00	100.00	88.00
5	76.00	94.00	93.30	70.00	95.00	90.00	82.00
6	94.00	96.00	100.00	92.00	100.00	100.00	90.00
7	78.00	100.00	93.30	96.00	100.00	100.00	90.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	92.35	5.00	5.00	168.00	226.00
2	90.66	7.00	7.00	195.00	261.00
3	98.07	1.00	1.00	184.00	248.00
4	96.01	2.00	3.00	180.00	242.00
5	92.62	6.00	6.00	167.00	222.00
6	95.85	3.00	2.00	192.00	254.00
7	95.15	4.00	4.00	192.00	259.00

DEMOGRAPHIC DATA FOR CLASS 89040 - 5/.2/89 - FILE: TAEDS40

HEADER DATA FOR: C:TAEDS40 LABEL: Demographics for Class S89040
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
	1**********	1.63	86.00	60.00	59.00	65.00	68.00
	2**********	1.72	96.00	63.00	63.00	66.00	67.00
	3**********	1.85	85.00	62.00	62.00	62.00	53.00
	4**********	1.41	77.00	55.00	56.00	55.00	62.00
	5**********	1.63	72.00	56.00	58.00	63.00	67.00
	6**********	1.61	64.00	51.00	58.00	66.00	55.00
+	7**********	2.18	89.00	59.00	62.00	67.00	60.00
	8**********	1.84	70.00	58.00	58.00	61.00	55.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	86.00	84.00	86.70	96.00	95.00	100.00	88.00
2	90.00	94.00	100.00	92.00	100.00	100.00	90.00
3	98.00	90.00	93.30	88.00	100.00	100.00	94.00
4	94.00	84.00	93.30	92.00	100.00	90.00	78.00
5	90.00	86.00	93.30	80.00	100.00	100.00	96.00
6	84.00	88.00	100.00	88.00	95.00	100.00	90.00
7	88.00	92.00	100.00	96.00	95.00	100.00	88.00
8	82.00	92.00	100.00	96.00	95.00	100.00	92.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	95.43	5.00	5.00	193.00	252.00
2	96.85	3.00	2.00	196.00	259.00
3	98.35	1.00	4.00	177.00	239.00
4	95.08	7.00	8.00	172.00	228.00
5	97.67	2.00	6.00	186.00	244.00
6	94.46	8.00	3.00	172.00	230.00
7	95.29	6.00	1.00	186.00	248.00
8	96.53	4.00	7.00	174.00	232.00

+ Indicates students dropped for missing data

DEMOGRAPHIC DATA FOR CLASS 89060 - 6/9/89 - FILE TAEDS60

HEADER DATA FOR: C:TAEDS60 LABEL: Demographics for Class S89060
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
1	1**********	1.48	81.00	58.00	62.00	64.00	62.00
2	2**********	1.47	99.00	63.00	64.00	64.00	69.00
3	3**********	1.60	96.00	62.00	60.00	58.00	67.00
4	4**********	6.49	78.00	52.00	60.00	61.00	54.00
5	5**********	1.52	64.00	53.00	59.00	63.00	53.00
6	6**********	1.67	72.00	62.00	55.00	58.00	64.00
7	7**********	1.57	62.00	60.00	50.00	57.00	58.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	76.00	88.00	86.70	80.00	80.00	90.00	84.00
2	90.00	92.00	100.00	88.00	95.00	70.00	88.00
3	78.00	92.00	86.70	76.00	90.00	80.00	88.00
4	78.00	86.00	93.30	88.00	75.00	90.00	84.00
5	86.00	86.00	93.30	84.00	100.00	90.00	90.00
6	88.00	92.00	100.00	76.00	80.00	100.00	88.00
7	82.00	90.00	93.30	84.00	100.00	90.00	74.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	93.20	5.00	3.00	184.00	246.00
2	96.80	1.00	2.00	196.00	260.00
3	92.22	7.00	1.00	187.00	247.00
4	94.16	3.00	6.00	167.00	227.00
5	93.06	6.00	5.00	169.00	228.00
6	94.22	2.00	7.00	184.00	239.00
7	93.80	4.00	4.00	175.00	225.00

DEMOGRAPHIC DATA FOR CLASS 89070 - 7/7/89 - FILE: TAEDS70

HEADER DATA FOR: C:TAEDS70 LABEL: Demographics for Class S89070
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
1	1**********	1.62	54.00	49.00	62.00	66.00	67.00
+	2**********	6.80	.00	.00	.00	.00	.00
3	3**********	5.06	74.00	48.00	66.00	68.00	61.00
4	4**********	1.53	76.00	62.00	63.00	57.00	67.00
5	5**********	1.47	73.00	56.00	59.00	64.00	64.00
6	6**********	7.93	68.00	62.00	53.00	52.00	65.00
7	7**********	1.56	87.00	58.00	58.00	64.00	64.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	90.00	88.00	93.30	96.00	100.00	100.00	80.00
2	86.00	80.00	86.70	88.00	95.00	90.00	80.00
3	94.00	94.00	93.30	92.00	95.00	100.00	94.00
4	100.00	92.00	100.00	100.00	95.00	100.00	88.00
5	92.00	96.00	73.30	88.00	100.00	100.00	82.00
6	74.00	84.00	100.00	88.00	90.00	100.00	80.00
7	86.00	84.00	93.30	92.00	95.00	100.00	86.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	93.24	5.00	4.00	182.00	244.00
2	92.52	6.00	6.00	.00	.00
3	94.98	1.00	1.00	177.00	243.00
4	96.01	4.00	2.00	186.00	249.00
5	93.51	2.00	5.00	184.00	243.00
6	88.73	7.00	7.00	179.00	232.00
7	94.29	3.00	3.00	186.00	244.00

+ Indicates students dropped for missing data

DEMOGRAPHIC DATA FOR CLASS 89080 - 8/4/89 - FILE: TAEDS80

HEADER DATA FOR: C:TAEDS80 LABEL: Demographics for Class S89080
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
+	1**********	1.39	85.00	.00	.00	.00	.00
+	2**********	.00	.00	.00	.00	.00	.00
	3**********	1.47	86.00	65.00	58.00	64.00	64.00
	4**********	2.14	91.00	62.00	62.00	60.00	58.00
	5**********	1.39	87.00	67.00	62.00	68.00	68.00
	6**********	1.55	75.00	62.00	64.00	64.00	56.00
	7**********	1.39	94.00	67.00	66.00	63.00	66.00
	8**********	1.30	93.00	58.00	63.00	61.00	62.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	82.00	88.00	80.00	84.00	85.00	90.00	90.00
2	78.00	80.00	93.30	76.00	80.00	90.00	84.00
3	96.00	96.00	100.00	88.00	90.00	90.00	90.00
4	90.00	90.00	93.30	88.00	90.00	80.00	84.00
5	96.00	94.00	93.30	100.00	95.00	100.00	88.00
6	96.00	90.00	86.70	80.00	90.00	90.00	86.00
7	88.00	84.00	86.70	88.00	90.00	100.00	88.00
8	92.00	94.00	86.70	84.00	95.00	90.00	86.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	91.87	7.00	7.00	.00	.00
2	89.00	8.00	8.00	.00	.00
3	96.79	3.00	2.00	193.00	251.00
4	94.62	5.00	5.00	180.00	242.00
5	98.07	1.00	6.00	203.00	265.00
6	96.96	2.00	4.00	182.00	246.00
7	94.77	4.00	3.00	196.00	262.00
8	94.04	6.00	1.00	181.00	244.00

+ Indicates students dropped for missing data

DEMOGRAPHIC DATA FOR CLASS 89100 - 8/25/89 - FILE: TAEDS100

HEADER DATA FOR: C:TAEDS100 LABEL: Demographics for Class S89100
NUMBER OF CASES: 9 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
+	1**********	5.64	.00	.00	.00	.00	.00
	2**********	1.29	93.00	63.00	64.00	64.00	64.00
	3**********	1.48	82.00	65.00	58.00	58.00	62.00
	4**********	1.54	80.00	63.00	62.00	55.00	64.00
	5**********	1.37	98.00	65.00	63.00	60.00	69.00
	6**********	1.41	75.00	65.00	62.00	61.00	67.00
	7**********	1.40	51.00	44.00	55.00	55.00	51.00
	8**********	1.35	82.00	62.00	60.00	61.00	62.00
	9**********	2.50	87.00	64.00	66.00	68.00	54.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	88.00	84.00	86.70	80.00	90.00	90.00	90.00
2	86.00	94.00	93.30	96.00	95.00	90.00	84.00
3	88.00	92.00	100.00	88.00	90.00	80.00	88.00
4	94.00	98.00	93.30	92.00	95.00	100.00	88.00
5	98.00	94.00	93.30	88.00	95.00	100.00	90.00
6	96.00	92.00	86.70	88.00	95.00	90.00	84.00
7	92.00	84.00	83.30	84.00	95.00	90.00	90.00
8	78.00	88.00	86.70	84.00	85.00	80.00	92.00
9	98.00	96.00	93.30	96.00	95.00	80.00	94.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	94.29	6.00	7.00	.00	.00
2	96.93	3.00	6.00	191.00	255.00
3	92.98	9.00	8.00	185.00	243.00
4	98.23	1.00	4.00	182.00	244.00
5	97.93	2.00	3.00	194.00	257.00
6	93.43	7.00	5.00	193.00	255.00
7	96.77	5.00	2.00	150.00	205.00
8	93.09	8.00	9.00	185.00	245.00
9	96.83	4.00	1.00	186.00	252.00

+ Indicates students dropped for missing data

DEMOGRAPHIC DATA FOR CLASS 89120 - 9/29/89 - FILE: TAEDS120

HEADER DATA FOR: C:TAEDS120 LABEL: Demographics for Class S89120
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 19

	SSN	TIS	AFQT	GS	AR	MK	EI
1	1**********	2.78	75.00	62.00	50.00	58.00	58.00
2	2**********	1.78	84.00	58.00	60.00	64.00	67.00
3	3**********	2.29	96.00	58.00	64.00	61.00	64.00
4	4**********	1.68	88.00	64.00	61.00	65.00	51.00
5	5**********	3.79	73.00	53.00	56.00	52.00	67.00
6	6**********	1.75	93.00	60.00	62.00	66.00	55.00
7	7**********	1.79	40.00	53.00	51.00	60.00	67.00

	FINAL 1	FINAL 2	FINAL 3	FINAL 4	FINAL 5	FINAL 6	COMP
1	86.00	96.00	73.30	96.00	80.00	100.00	86.00
2	96.00	92.00	93.30	88.00	95.00	90.00	90.00
3	94.00	92.00	100.00	92.00	90.00	90.00	82.00
4	96.00	98.00	86.70	84.00	90.00	100.00	84.00
5	80.00	90.00	100.00	92.00	100.00	100.00	86.00
6	94.00	88.00	100.00	96.00	85.00	100.00	96.00
7	84.00	86.00	86.70	80.00	100.00	100.00	84.00

	FINAL SC	CLASS ST	INST RNK	ASVAB 1	ASVAB T
1	92.26	7.00	4.00	178.00	228.00
2	96.50	3.00	2.00	189.00	249.00
3	96.12	4.00	7.00	183.00	247.00
4	96.56	2.00	3.00	180.00	241.00
5	95.75	5.00	5.00	172.00	228.00
6	97.99	1.00	1.00	181.00	243.00
7	95.39	6.00	6.00	180.00	231.00

INSTRUCTOR DEMOGRAPHIC DATA

DEMOGRAPHIC DATA FOR INSTRUCTORS - FILE: TAEDINST

HEADER DATA FOR: C:TAEDINST LABEL: Demographics for Instructors
NUMBER OF CASES: 13 NUMBER OF VARIABLES: 1

	TIS
1	9.00
2	12.75
3	15.00
4	8.75
+ 5	6.50
6	6.58
7	13.83
8	7.42
9	8.92
+10	7.67
11	7.50
12	6.92
13	17.83

+ Indicates instructors did not hold NEC ET-1453

TIME IN SERVICE FOR INSTRUCTORS

HEADER DATA FOR: C:TIS-INST LABEL: TIME IN SERVICE FOR INSTRUCTORS
NUMBER OF CASES: 11 NUMBER OF VARIABLES: 1

	TIS
1	9.00
2	12.75
3	15.00
4	8.75
5	6.58
6	13.83
7	7.42
8	8.92
9	7.50
10	6.92
11	17.83

---------- DESCRIPTIVE STATISTICS ----------

HEADER DATA FOR: C:TIS-INST LABEL: TIME IN SERVICE FOR INSTRUCTORS
NUMBER OF CASES: 11 NUMBER OF VARIABLES: 1

NO.	NAME	N	MEAN	STD. DEV.	MINIMUM	MAXIMUM
1	TIS	11	10.4091	3.8015	6.5800	17.8300

INSTRUCTOR DEMOGRAPHIC DATA

TIS	RATE	TIP	NEC	FLEET	INSTRUCTOR
9.00	ET1	13	60	36	15
12.75	ET1	30	48	48	1
15.00	ET1	79	72	36	24
8.75	ET2	33	57	46	2
6.58	ET1	8	42	24	9
13.83	ET1	86	76	36	41
7.42	ET2	20	30	30	1
8.92	ET1	48	72	48	36
7.50	ET1	100	58	24	23
6.92	ET1	30	48	42	2
17.83	ET1	33	53	18	24

TIS	Time in service (years)
RATE	Rate/Rating
TIP	Time in paygrade (months)
NEC	Time in NEC ET-1453 (months)
FLEET	Time working with NAVMACS System in Fleet (months)
INSTRUCTOR	Time as NAVMACS Instructor (months)

APPENDIX B

HYPOTHESES TESTING DATA

Note. Hypotheses 2 and 16 were dropped.

HYPOTHESIS 1

HYP 1 VAR - TAE FINAL SCORE FOR EACH CASE - STUDENTS & INSTRUCT

HEADER DATA FOR: C:HYP1 LABEL: TAE FINAL SCORE MEANS FOR EACH CASE -S/I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 1

	TAESCORE
1	69.68
2	60.88
3	76.64
4	70.83
5	69.46
6	81.47
7	70.49
8	55.88
9	75.45
10	70.15
11	66.05
12	73.57
13	58.61
14	56.83
15	70.87
16	73.49
17	75.85
18	75.54
19	65.63
20	69.18
21	75.34
22	61.81
23	66.73
24	72.31
25	67.35
26	60.78
27	76.54
28	67.94
29	66.67
30	78.08
31	68.05
32	71.01
33	68.19
34	66.80
35	69.62
36	65.84
37	72.05
38	75.89
39	74.63
40	76.99
41	74.49
42	71.82
43	78.35
44	68.74
45	76.29
46	70.05
47	79.77
48	70.35
49	79.74
50	67.65
51	66.20
52	74.15
53	73.51
54	80.18
55	68.85
56	81.39
57	62.35
58	81.42
59	72.20

---------- ANALYSIS OF VARIANCE ----------

HEADER DATA FOR: C:TAESCORE LABEL: TAE FINAL SCORE MEANS FOR EACH CASE -S
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 1

ONE-WAY ANOVA

HYPOTHESIS 1 TEST - ANOVA: TAE FINAL SCORES - STUDENT vs INSTRUC

GROUP	MEAN	N
1	70.396	48
2	73.422	11
GRAND MEAN	70.960	59

VARIABLE 1: TAESCORE

SOURCE	SUM OF SQUARES	D.F.	MEAN SQUARE	F RATIO	PROB.
BETWEEN	81.973	1	81.973	2.271	.1373
WITHIN	2057.124	57	36.090		
TOTAL	2139.098	58			

HYPOTHESIS 3

Note: Hypothesis 2 was dropped.

HYPOTHESIS 3 VAR - TIS AND AVG FINAL SCORE - STUDENTS & INSTRUCT

HEADER DATA FOR: C:HYP3 LABEL: HYP 3 VAR - AVG FIN SCORE & TIS - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TIS	TAESCORE
1	1.50	69.68
2	1.58	60.88
3	9.25	76.64
4	1.83	70.83
5	2.00	69.46
6	2.00	81.47
7	4.83	70.49
8	1.63	55.88
9	1.72	75.45
10	1.85	70.15
11	1.41	66.05
12	1.63	73.57
13	1.61	58.61
14	1.84	56.83
15	1.48	70.87
16	1.47	73.49
17	1.60	75.85
18	6.49	75.54
19	1.50	65.63
20	1.67	69.18
21	1.57	75.34
22	1.62	61.81
23	5.06	66.73
24	1.53	72.31
25	1.47	67.35
26	7.93	60.78
27	1.56	76.54
28	1.47	67.94
29	2.14	66.67
30	1.39	78.08
31	1.55	68.05
32	1.39	71.01
33	1.30	68.19
34	1.29	66.80
35	1.48	69.62
36	1.54	65.84
37	1.37	72.05
38	1.41	75.89
39	1.40	74.63
40	1.35	76.99
41	2.50	74.49
42	2.78	71.82
43	1.78	78.35
44	2.29	68.74
45	1.68	76.29
46	3.79	70.05
47	1.75	79.77
48	1.79	70.35
49	9.00	79.74
50	12.75	67.65
51	15.00	66.20
52	8.75	74.15
53	6.58	73.51
54	13.83	80.18
55	7.42	68.85
56	8.92	81.39
57	7.50	62.35
58	6.92	81.42
59	17.83	72.20

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP3 LABEL: HYP 3 VAR - AVG FIN SCORE & TIS - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

TESTING OF HYPOTHESIS 3 - CORRELATION OF TIS AND FINAL SCORE

	TIS	FINSCORE
TIS	1.00000	
FINSCORE	.13676	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 4

HYPOTHESIS 4 VAR - SCHOOL FINAL SCORE vs TAE FINAL SCORE - STDNT

HEADER DATA FOR: C:HYP4 LABEL: HYP 4 VAR - TAE FIN SC vs SCHOOL FIN SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

	SCLSCORE	TAESCORE
1	92.35	69.68
2	90.66	60.88
3	98.07	76.64
4	96.01	70.83
5	92.62	69.46
6	95.85	81.47
7	95.15	70.49
8	95.43	55.88
9	96.85	75.45
10	98.35	70.15
11	95.08	66.05
12	97.67	73.57
13	94.46	58.61
14	96.53	56.83
15	93.20	70.87
16	96.80	73.49
17	92.22	75.85
18	94.16	75.54
19	93.06	65.63
20	94.22	69.18
21	93.80	75.34
22	93.24	61.81
23	94.98	66.73
24	96.01	72.31
25	93.51	67.35
26	88.73	60.78
27	94.29	76.54
28	96.79	67.94
29	94.62	66.67
30	98.07	78.08
31	96.96	68.05
32	94.77	71.01
33	94.04	68.19
34	96.93	66.80
35	92.98	69.62
36	98.23	65.84
37	97.93	72.05
38	93.43	75.89
39	96.77	74.63
40	93.09	76.99
41	96.83	74.49
42	92.26	71.82
43	96.50	78.35
44	96.12	68.74
45	96.56	76.29
46	95.75	70.05
47	97.99	79.77
48	95.39	70.35

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP4 LABEL: HYP 4 VAR - TAE FIN SC vs SCHOOL FIN SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

HYPOTHESIS 4 TESTING - CORRELATION OF SCHL FIN SC vs TAE FIN SC

	SCLSCORE	TAESCORE
SCLSCORE	1.00000	
TAESCORE	.30181	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYP 4 COMP VAR - SCHOOL COMP SCORE vs STUDENT TAE FINAL SCORE

HEADER DATA FOR: C:HYP4COMP LABEL: HYP 4 COMP VAR - TAE FIN SC vs SCH COM
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

	COMPSCOR	TAESCORE
1	78.00	69.68
2	92.00	60.88
3	96.00	76.64
4	88.00	70.83
5	82.00	69.46
6	90.00	81.47
7	90.00	70.49
8	88.00	55.88
9	90.00	75.45
10	94.00	70.15
11	78.00	66.05
12	96.00	73.57
13	90.00	58.61
14	92.00	56.83
15	84.00	70.87
16	88.00	73.49
17	88.00	75.85
18	84.00	75.54
19	90.00	65.63
20	88.00	69.18
21	74.00	75.34
22	80.00	61.81
23	94.00	66.73
24	88.00	72.31
25	82.00	67.35
26	80.00	60.78
27	86.00	76.54
28	90.00	67.94
29	84.00	66.67
30	88.00	78.08
31	86.00	68.05
32	88.00	71.01
33	86.00	68.19
34	84.00	66.80
35	88.00	69.62
36	88.00	65.84
37	90.00	72.05
38	84.00	75.89
39	90.00	74.63
40	92.00	76.99
41	94.00	74.49
42	86.00	71.82
43	90.00	78.35
44	82.00	68.74
45	84.00	76.29
46	86.00	70.05
47	96.00	79.77
48	84.00	70.35

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP4COMP LABEL: HYP 4 COMP VAR - TAE FIN SC vs SCH COM
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

HYP 4 COMP TESTING - CORRELATION OF SCHL COMP SC vs TAE FINAL SC

	COMPSCOR	TAESCORE
COMPSCOR	1.00000	
TAESCORE	.17311	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYPOTHESIS 5

HYPOTHESIS 5 VARIABLES - SUBSYSTEM 1 - SCHOOL FINAL 1 vs TAE AVG

HEADER DATA FOR: C:HYP5SS1 LABEL: HYP 5 - SS1 VAR - TAE AVG SC vs FINAL 1
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

	SCHL-SS1	TAE-SS1
1	72.00	70.39
2	70.00	80.00
3	92.00	75.21
4	74.00	88.50
5	76.00	61.04
6	94.00	87.55
7	78.00	80.38
8	86.00	44.95
9	90.00	86.05
10	98.00	78.13
11	94.00	83.35
12	90.00	88.01
13	84.00	74.36
14	82.00	41.51
15	76.00	78.51
16	90.00	89.95
17	78.00	78.06
18	78.00	89.75
19	86.00	68.61
20	88.00	82.95
21	82.00	89.95
22	90.00	46.41
23	94.00	88.16
24	100.00	91.65
25	92.00	87.20
26	74.00	69.90
27	86.00	80.05
28	96.00	85.65
29	90.00	84.85
30	96.00	74.85
31	96.00	82.26
32	88.00	85.38
33	92.00	78.59
34	86.00	73.79
35	88.00	58.65
36	94.00	78.89
37	98.00	84.70
38	96.00	79.04
39	92.00	83.95
40	78.00	82.70
41	98.00	88.80
42	86.00	70.50
43	96.00	87.55
44	94.00	81.44
45	96.00	82.44
46	80.00	73.61
47	94.00	90.35
48	84.00	74.15

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP5SS1 LABEL: HYP 5 - SS1 VAR - TAE AVG SC vs FINAL
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

HYP 5 TEST - SS1 - CORRELATION SCHOOL FINAL 1 vs TAE AVERAGE SC

	SCHL-SS1	TAE-SS1
SCHL-SS1	1.00000	
TAE-SS1	.27704	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYPOTHESIS 5 VARIABLES - SUBSYSTEM 2 - SCHOOL FINAL 2 vs TAE AVG

HEADER DATA FOR: C:HYP5SS2 LABEL: HYP 5 - SS2 VAR - TAE AVG SC vs FINAL 2
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

	SCHL-SS2	TAE-SS2
1	82.00	64.70
2	90.00	52.69
3	98.00	82.21
4	92.00	77.27
5	94.00	75.15
6	96.00	77.59
7	100.00	69.61
8	84.00	59.34
9	94.00	72.44
10	90.00	71.37
11	84.00	70.06
12	86.00	77.43
13	88.00	56.20
14	92.00	54.27
15	88.00	67.65
16	92.00	84.05
17	92.00	72.12
18	86.00	74.93
19	86.00	67.75
20	92.00	68.97
21	90.00	75.37
22	88.00	69.03
23	94.00	67.89
24	92.00	69.44
25	96.00	62.64
26	84.00	63.37
27	84.00	79.93
28	96.00	70.55
29	90.00	61.45
30	94.00	83.69
31	90.00	62.75
32	84.00	67.82
33	94.00	64.56
34	94.00	66.54
35	92.00	79.11
36	98.00	65.87
37	94.00	73.25
38	92.00	82.58
39	84.00	73.94
40	88.00	79.85
41	96.00	74.78
42	96.00	75.45
43	92.00	80.83
44	92.00	75.13
45	98.00	74.45
46	90.00	73.15
47	88.00	81.36
48	86.00	69.01

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP5SS2 LABEL: HYP 5 - SS2 VAR - FINAL 2 vs TAE AVG SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

HYP 5 TEST - SS2 - CORRELATION SCHOOL FINAL 2 vs TAE AVERAGE SC

	SCHL-SS2	TAE-SS2
SCHL-SS2	1.00000	
TAE-SS2	.17579	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYPOTHESIS 5 VARIABLES - SUBSYSTEM 3 - SCHOOL FINAL 3 vs TAE AVG

HEADER DATA FOR: C:HYP5SS3 LABEL: HYP 5 - SS3 VAR - FINAL 3 vs TAE AVG SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

	SCHL-SS3	TAE-SS3
1	86.70	98.35
2	86.70	93.55
3	93.30	98.65
4	86.70	98.25
5	93.30	93.00
6	100.00	91.90
7	93.30	95.50
8	86.70	93.60
9	100.00	99.75
10	93.30	99.00
11	93.30	98.75
12	93.30	98.95
13	100.00	93.40
14	100.00	96.75
15	86.70	98.90
16	100.00	73.35
17	86.70	85.90
18	93.30	99.15
19	93.30	95.95
20	100.00	97.00
21	93.30	91.95
22	93.30	74.86
23	93.30	91.45
24	100.00	88.25
25	73.30	92.55
26	100.00	93.45
27	93.30	95.70
28	100.00	80.25
29	93.30	86.80
30	93.30	96.75
31	86.70	98.40
32	86.70	83.95
33	86.70	86.20
34	93.30	99.00
35	100.00	84.50
36	93.30	80.86
37	93.30	99.50
38	86.70	87.20
39	83.30	99.25
40	86.70	95.50
41	93.30	97.65
42	73.30	95.50
43	93.30	96.35
44	100.00	79.31
45	86.70	99.45
46	100.00	97.15
47	100.00	98.75
48	86.70	97.05

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP5SS3 LABEL: HYP 5 - SS3 VAR - FINAL 3 vs TAE AVG SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

HYP 5 TEST - SS3 - CORRELATION SCHOOL FINAL 3 vs TAE AVERAGE SC

	SCHL-SS3	TAE-SS3
SCHL-SS3	1.00000	
TAE-SS3	-.18146	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYPOTHESIS 5 VARIABLES - SUBSYSTEM 4 - SCHOOL FINAL 5 vs TAE AVG

HEADER DATA FOR: C:HYP5SS4 LABEL: HYP 5 - SS4 VAR - FINAL 5 vs TAE AVG SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

	SCHL-SS4	TAE-SS4
1	75.00	60.24
2	85.00	41.85
3	100.00	33.75
4	100.00	.00
5	95.00	31.54
6	100.00	80.50
7	100.00	39.14
8	95.00	15.25
9	100.00	52.58
10	100.00	28.39
11	100.00	.00
12	100.00	18.29
13	95.00	17.69
14	95.00	42.45
15	80.00	48.09
16	95.00	14.94
17	90.00	78.48
18	75.00	40.15
19	100.00	23.85
20	80.00	28.44
21	100.00	44.00
22	100.00	35.25
23	95.00	15.95
24	95.00	48.48
25	100.00	41.18
26	90.00	8.59
27	95.00	40.29
28	90.00	27.48
29	90.00	49.19
30	95.00	40.24
31	90.00	44.68
32	90.00	56.44
33	95.00	54.29
34	95.00	28.67
35	90.00	27.74
36	95.00	37.64
37	95.00	27.14
38	95.00	34.67
39	95.00	43.44
40	85.00	41.29
41	95.00	35.88
42	80.00	34.94
43	95.00	41.23
44	90.00	19.90
45	90.00	54.39
46	100.00	26.98
47	85.00	43.89
48	100.00	45.24

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP5SS4 LABEL: HYP 5 - SS4 VAR - FINAL 5 vs TAE AVG SC
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 2

HYP 5 TEST - SS4 - CORRELATION SCHOOL FINAL 5 vs TAE AVERAGE SC

	SCHL-SS4	TAE-SS4
SCHL-SS4	1.00000	
TAE-SS4	-.21972	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYPOTHESIS 6

HYPOTHESIS 6 VAR - TAE AVG SC/AFQT/GS/AR/MK/EI/ASVAB-1/ASVAB-T

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT & INSTR
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

	TAESCORE	AFQT	GS	AR	MK	EI	ASVAB-1
1	69.68	74.00	62.00	58.00	62.00	44.00	168.00
2	60.88	99.00	64.00	66.00	68.00	63.00	195.00
3	76.64	83.00	58.00	64.00	64.00	62.00	184.00
4	70.83	91.00	62.00	62.00	65.00	53.00	180.00
5	69.46	72.00	60.00	55.00	52.00	55.00	167.00
6	81.47	83.00	62.00	62.00	66.00	64.00	192.00
7	70.49	98.00	65.00	67.00	71.00	56.00	192.00
8	55.88	86.00	60.00	59.00	65.00	68.00	193.00
9	75.45	96.00	63.00	63.00	66.00	67.00	196.00
10	70.15	85.00	62.00	62.00	62.00	53.00	177.00
11	66.05	77.00	55.00	56.00	55.00	62.00	172.00
12	73.57	72.00	56.00	58.00	63.00	67.00	186.00
13	58.61	64.00	51.00	58.00	66.00	55.00	172.00
14	56.83	70.00	58.00	58.00	61.00	55.00	174.00
15	70.87	81.00	58.00	62.00	64.00	62.00	184.00
16	73.49	99.00	63.00	64.00	64.00	69.00	196.00
17	75.85	96.00	62.00	60.00	58.00	67.00	187.00
18	75.54	78.00	52.00	60.00	61.00	54.00	167.00
19	65.63	64.00	53.00	59.00	63.00	53.00	169.00
20	69.18	72.00	62.00	55.00	58.00	64.00	184.00
21	75.34	62.00	60.00	50.00	57.00	58.00	175.00
22	61.81	54.00	49.00	62.00	66.00	67.00	182.00
23	66.73	74.00	48.00	66.00	66.00	61.00	177.00
24	72.31	76.00	62.00	63.00	57.00	67.00	186.00
25	67.35	73.00	56.00	59.00	64.00	64.00	184.00
26	60.78	68.00	62.00	53.00	52.00	65.00	179.00
27	76.54	87.00	58.00	58.00	64.00	64.00	186.00
28	67.94	86.00	65.00	58.00	64.00	64.00	193.00
29	66.67	91.00	62.00	62.00	60.00	58.00	180.00
30	78.08	87.00	67.00	62.00	68.00	68.00	203.00
31	68.05	75.00	62.00	64.00	64.00	56.00	182.00
32	71.01	94.00	67.00	66.00	63.00	66.00	196.00
33	68.19	93.00	58.00	63.00	61.00	62.00	181.00
34	66.80	93.00	63.00	64.00	64.00	64.00	191.00
35	69.62	82.00	65.00	58.00	58.00	62.00	185.00
36	65.84	80.00	63.00	62.00	55.00	64.00	182.00
37	72.05	98.00	65.00	63.00	60.00	69.00	194.00
38	75.89	75.00	65.00	62.00	61.00	67.00	193.00
39	74.63	51.00	44.00	55.00	55.00	51.00	150.00
40	76.99	82.00	62.00	60.00	61.00	62.00	185.00
41	74.49	87.00	64.00	66.00	68.00	54.00	186.00
42	228.00	75.00	62.00	50.00	58.00	58.00	178.00
43	78.35	84.00	58.00	60.00	64.00	67.00	189.00
44	68.74	96.00	58.00	64.00	61.00	64.00	183.00
45	76.29	88.00	64.00	61.00	65.00	51.00	180.00
46	70.05	73.00	53.00	56.00	52.00	67.00	172.00
47	79.77	93.00	60.00	62.00	66.00	55.00	181.00
48	70.35	40.00	53.00	51.00	60.00	67.00	180.00

	ASVAB-T
1	226.00
2	261.00
3	248.00
4	242.00
5	222.00
6	254.00
7	259.00
8	252.00
9	259.00
10	239.00
11	228.00
12	244.00
13	230.00
14	232.00
15	246.00
16	260.00
17	247.00
18	227.00
19	228.00
20	239.00
21	225.00
22	244.00
23	243.00
24	249.00
25	243.00
26	232.00
27	244.00
28	251.00
29	242.00
30	265.00
31	246.00
32	262.00
33	244.00
34	255.00
35	243.00
36	244.00
37	257.00
38	255.00
39	205.00
40	245.00
41	252.00
42	228.00
43	249.00
44	247.00
45	241.00
46	228.00
47	243.00
48	231.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE AND AFQT

	TAESCORE	AFQT
TAESCORE	1.00000	
AFQT	-.00398	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE AND GS

	TAESCORE	GS
TAESCORE	1.00000	
GS	.11462	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE AND AR

	TAESCORE	AR
TAESCORE	1.00000	
AR	-.32510	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE AND MK

	TAESCORE	MK
TAESCORE	1.00000	
MK	-.10088	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE AND EI

	TAESCORE	EI
TAESCORE	1.00000	
EI	-.06673	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE & ASVAB1

	TAESCORE	ASVAB-1
TAESCORE	1.00000	
ASVAB-1	-.02672	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP6VAR LABEL: HYPOTHESIS 6 VARIABLES - STUDENT ONLY
NUMBER OF CASES: 48 NUMBER OF VARIABLES: 8

HYPOTHESIS 6 TEST - CORRELATION BETWEEN TAE FINAL SCORE & ASVABT

	TAESCORE	ASVAB-T
TAESCORE	1.00000	
ASVAB-T	-.13055	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .24045
CRITICAL VALUE (2-tail, .05) = +/- .28419

N = 48

HYPOTHESIS 7

HYPOTHESIS 7 VAR - TAE AVERAGE SCORE vs NUMBER VALID CHECKS S/I

HEADER DATA FOR: C:HYP7 LABEL: HYP 7 VAR - TAE AVG SC vs INVALID CHECKS
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	INVALCKS
1	69.68	.00
2	60.88	.00
3	76.64	.00
4	70.83	.29
5	69.46	.21
6	81.47	.00
7	70.49	.21
8	55.88	.00
9	75.45	.00
10	70.15	.14
11	66.05	.00
12	73.57	.00
13	58.61	.00
14	56.83	.29
15	70.87	.00
16	73.49	.21
17	75.85	.00
18	75.54	.00
19	65.63	.00
20	69.18	.07
21	75.34	.14
22	61.81	.00
23	66.73	.00
24	72.31	.00
25	67.35	.00
26	60.78	.00
27	76.54	.00
28	67.94	.07
29	66.67	.00
30	78.08	.00
31	68.05	.36
32	71.01	.00
33	68.19	.14
34	66.80	.14
35	69.62	.07
36	65.84	.00
37	72.05	.21
38	75.89	.00
39	74.63	.00
40	76.99	.00
41	74.49	.07
42	71.82	.21
43	78.35	.00
44	68.74	.00
45	76.29	.14
46	70.05	.07
47	79.77	.00
48	70.35	.00
49	79.74	.00
50	67.65	.00
51	66.20	.57
52	74.15	.00
53	73.51	.00
54	80.18	.07
55	68.85	.14
56	81.39	.00
57	62.35	.00
58	81.42	.00
59	72.20	.07

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP7 LABEL: HYP 7 VAR - TAE AVG SC vs INVALID CHECKS
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 7 TESTING: CORRELATION OF TAE FIN SC & # INVALID CHKS

	TAESCORE	INVALCKS
TAESCORE	1.00000	
INVALCKS	-.17107	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESES 8 - 11

LIST OF VARIABLES TO TEST HYPOTHESES 8-11 - STUDENTS & INSTRUCT

HEADER DATA FOR: C:HYP8-11 LABEL: VAR FOR HYPOTHESES 8 - 11 - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 5

	TAESCORE	ILL APPR	INC SOLU	REDUN CK	PROOF PT
1	69.68	.21	2.71	.29	.64
2	60.88	.07	5.21	.07	.43
3	76.64	.14	3.07	.14	.64
4	70.83	.07	4.71	.07	.93
5	69.46	.14	2.43	.14	.79
6	81.47	.07	.64	.00	.93
7	70.49	.36	2.14	.00	.43
8	55.88	.29	10.64	.07	.21
9	75.45	.00	1.64	.00	.36
10	70.15	.14	3.43	.36	.50
11	66.05	.71	4.57	.07	.43
12	73.57	.14	3.00	.00	.50
13	58.61	.14	5.71	.57	.43
14	56.83	.14	5.71	.00	.43
15	70.87	.14	2.21	.50	.50
16	73.49	.36	1.07	.29	1.07
17	75.85	.00	3.36	.00	.50
18	75.54	.29	2.64	.29	.57
19	65.63	.07	6.71	.00	.36
20	69.18	.29	3.07	.29	.43
21	75.34	.14	2.57	.29	1.36
22	61.81	.43	5.50	.00	.36
23	66.73	.36	8.86	.00	.43
24	72.31	.21	1.14	.07	.43
25	67.35	.29	3.21	.07	.50
26	60.78	.43	8.93	.00	.29
27	76.54	.21	1.36	.07	.57
28	67.94	.29	1.86	.71	.64
29	66.67	.29	1.93	.07	.43
30	78.08	.00	2.86	.07	1.14
31	68.05	.00	5.43	1.00	.36
32	71.01	.43	4.79	.14	.29
33	68.19	.14	4.29	.00	.36
34	66.80	.14	1.43	.21	.71
35	69.62	.00	2.07	.21	.79
36	65.84	.00	3.07	.36	.57
37	72.05	.14	2.79	.50	.64
38	75.89	.07	.86	.36	1.14
39	74.63	.00	1.29	.21	.64
40	76.99	.00	1.79	.07	.50
41	74.49	.00	1.86	.14	.57
42	71.82	.07	4.36	.29	.43
43	78.35	.00	1.14	.07	.57
44	68.74	.21	3.79	.43	.64
45	76.29	.14	2.43	.64	.64
46	70.05	.21	2.86	.29	.64
47	79.77	.07	1.07	.36	.64
48	70.35	.36	1.36	.21	.64
49	79.74	.07	1.57	.00	.93
50	67.65	.21	4.50	.07	.57
51	66.20	.00	4.86	.21	.57
52	74.15	.29	.71	.29	.71
53	73.51	.43	1.79	.50	.93
54	80.18	.14	4.64	.00	.93
55	68.85	.07	5.21	.43	.50
56	81.39	.00	2.00	.14	1.00
57	62.35	.07	3.71	.14	.93
58	81.42	.00	.50	.07	1.21
59	72.20	00	4.14	.07	.71

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP8-11 LABEL: VAR FOR HYPOTHESES 8 - 11 - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 5

HYP 8 TEST - CORRELATION: TAE FINAL SCORE & ILLOGICAL APPROACHES

	TAESCORE	ILL APPR
TAESCORE	1.00000	
ILL APPR	-.34057	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP8-11 LABEL: VAR FOR HYPOTHESES 8 - 11 - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 5

HYP 9 TEST - CORRELATION: TAE FINAL SCORE & INCORRECT SOLUTIONS

	TAESCORE	INC SOLU
TAESCORE	1.00000	
INC SOLU	-.69676	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP8-11 LABEL: VAR FOR HYPOTHESES 8 - 11 - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 5

HYP 10 TEST - CORRELATION: TAE FINAL SCORE & REDUNDANT CHECKS

	TAESCORE	REDUN CK
TAESCORE	1.00000	
REDUN CK	-.08543	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP8-11 LABEL: VAR FOR HYPOTHESES 8 - 11 - S & I
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 5

HYP 11 TEST - CORRELATION: TAE FINAL SCORE & PROOF POINTS

	TAESCORE	PROOF PT
TAESCORE	1.00000	
PROOF PT	.56097	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 12

HYPOTHESIS 12 VAR - TAE FINAL SCORE vs AVERAGE NUMBER OF TESTS

HEADER DATA FOR: C:HYP12 LABEL: HYP 12 VAR - TAE SC vs NUMBER OF TESTS
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	# TESTS
1	69.68	5.08
2	60.88	4.97
3	76.64	3.12
4	70.83	3.55
5	69.46	4.86
6	81.47	2.75
7	70.49	2.86
8	55.88	5.45
9	75.45	2.77
10	70.15	3.62
11	66.05	5.01
12	73.57	3.32
13	58.61	5.78
14	56.83	3.82
15	70.87	4.16
16	73.49	3.60
17	75.85	3.40
18	75.54	4.23
19	65.63	3.82
20	69.18	3.11
21	75.34	4.85
22	61.81	3.08
23	66.73	4.87
24	72.31	2.55
25	67.35	3.91
26	60.78	4.55
27	76.54	3.66
28	67.94	3.68
29	66.67	3.32
30	78.08	2.92
31	68.05	4.67
32	71.01	3.39
33	68.19	4.06
34	66.80	3.86
35	69.62	4.53
36	65.84	3.56
37	72.05	4.06
38	75.89	3.20
39	74.63	3.46
40	76.99	2.99
41	74.49	2.90
42	71.82	3.31
43	78.35	3.11
44	68.74	5.53
45	76.29	3.03
46	70.05	3.27
47	79.77	3.56
48	70.35	5.38
49	79.74	3.08
50	67.65	4.02
51	66.20	5.08
52	74.15	3.56
53	73.51	4.90
54	80.18	3.65
55	68.85	3.37
56	81.39	2.68
57	62.35	5.51
58	81.42	3.99
59	72.20	4.27

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP12 LABEL: HYP 12 VAR - TAE SC vs NUMBER OF TESTS
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 12 - CORRELATION: TAE FINAL SCORE vs NUMBER OF TESTS

	TAESCORE	# TESTS
TAESCORE	1.00000	
# TESTS	-.55201	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 13

DIFFICULTY TOTAL SCORES & Z SCORES - EPISODES IN ORIGINAL ORDER

HEADER DATA FOR: C:ZSCORES LABEL: DIFF Z SCORES - EPs IN ORIGINAL ORDER
NUMBER OF CASES: 14 NUMBER OF VARIABLES: 2

	EPISODE	Z SCORES
1	2806.00	-.81
2	2948.00	-.77
3	2345.00	-.94
4	4917.00	-.19
5	8466.00	.85
6	9357.00	1.11
7	1625.00	-1.15
8	1686.00	-1.14
9	9636.00	1.20
10	12159.00	1.94
11	5393.00	-.05
12	3093.00	-.72
13	8049.00	.73
14	5311.00	-.07

HYPOTHESIS 13 VARIABLES - TAE EPISODE AVERAGE TIME vs Z SCORE

HEADER DATA FOR: C:HYP13 LABEL: HYP 12 VAR - EPISODE AVG TIME vs Z SCORE
NUMBER OF CASES: 14 NUMBER OF VARIABLES: 2

	AVGTIME	ZSCORE
1	6.90	-.81
2	7.93	-.77
3	11.20	-.94
4	20.12	-.19
5	21.76	.85
6	22.80	1.11
7	3.54	-1.15
8	3.90	-1.14
9	40.31	1.20
10	46.29	1.94
11	17.54	-.05
12	10.37	-.72
13	35.83	.73
14	21.75	-.07

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP13 LABEL: HYP 12 VAR - EPISODE AVG TIME vs Z SCORE
NUMBER OF CASES: 14 NUMBER OF VARIABLES: 2

HYPOTHESIS 13 - CORRELATION: EPISODE DIFFICULTY vs EPISODE TIME

	AVGTIME	ZSCORE
AVGTIME	1.00000	
ZSCORE	.93051	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .45900
CRITICAL VALUE (2-tail, .05) = +/- .53067

N = 14

HYPOTHESIS 14

HYPOTHESIS 14 VAR - LEVEL 1 DIFF - TAE FIN SC vs TAE TOTAL TIME

HEADER DATA FOR: C:HYP14-1 LABEL: HYP 14 - LEVEL 1 VAR - EPISODES 7 AND 8
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TAE TIME
1	98.35	1.50
2	93.55	5.50
3	98.65	1.50
4	98.25	3.50
5	93.00	5.00
6	91.90	5.00
7	95.50	3.00
8	93.60	1.00
9	99.75	.50
10	99.00	2.00
11	98.75	2.50
12	98.95	1.50
13	93.40	2.00
14	96.75	1.50
15	98.90	1.00
16	73.35	9.50
17	85.90	2.00
18	99.15	.50
19	95.95	1.50
20	97.00	3.00
21	91.95	2.50
22	74.86	9.50
23	91.45	3.50
24	88.25	3.50
25	92.55	2.50
26	93.45	4.50
27	95.70	2.00
28	80.25	9.50
29	86.80	9.00
30	96.75	1.50
31	98.40	2.00
32	83.95	5.50
33	86.20	5.00
34	99.00	2.00
35	84.50	8.00
36	80.86	12.50
37	99.50	1.00
38	87.20	5.00
39	99.25	1.50
40	95.50	4.00
41	97.65	3.50
42	95.50	3.00
43	96.35	5.50
44	79.31	15.00
45	99.45	.50
46	97.15	4.50
47	98.75	2.50
48	97.05	3.50
49	98.60	1.00
50	95.40	2.00
51	97.75	1.50
52	98.20	3.00
53	97.70	4.00
54	97.90	3.00
55	98.15	2.50
56	84.75	5.50
57	86.75	3.50
58	97.70	4.00
59	92.35	3.50

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP14-1 LABEL: HYP 14 - LEVEL 1 VAR - EPISODES 7 AND 8
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 14 - LEVEL 1 DIFFICULTY - CORR: FIN SC vs TOTAL TIME

	TAESCORE	TAE TIME
TAESCORE	1.00000	
TAE TIME	-.81265	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 14 VAR - LEVEL 2 DIFF - TAE FIN SC vs TAE TOTAL TIME

HEADER DATA FOR: C:HYP14-2 LABEL: HYP 14 - LEVEL 2 VAR - EPs 1, 2, 3, & 12
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TAE TIME
1	75.37	11.75
2	74.64	12.00
3	82.80	3.25
4	91.12	9.25
5	79.59	16.00
6	78.63	11.50
7	73.86	14.25
8	52.00	11.25
9	70.45	6.75
10	78.79	9.50
11	81.98	4.00
12	81.78	5.00
13	68.40	7.25
14	69.20	11.75
15	79.35	4.25
16	88.30	12.50
17	84.09	6.50
18	78.26	8.75
19	67.21	15.00
20	69.95	12.75
21	90.97	5.75
22	76.07	13.75
23	76.85	4.75
24	73.72	7.00
25	85.69	5.50
26	75.05	9.25
27	89.12	7.25
28	77.63	9.25
29	69.68	13.00
30	84.32	8.75
31	75.67	5.50
32	82.95	3.25
33	79.16	5.25
34	90.57	9.75
35	88.62	11.75
36	77.94	9.50
37	76.13	9.50
38	84.34	10.00
39	83.04	9.00
40	83.89	7.50
41	85.94	7.50
42	80.55	10.25
43	87.39	8.50
44	87.19	10.50
45	83.58	7.75
46	75.78	7.50
47	88.14	7.00
48	77.84	10.00
49	83.91	4.25
50	81.41	10.75
51	75.27	19.75
52	79.11	11.75
53	89.87	7.75
54	89.72	8.25
55	79.93	9.00
56	94.83	6.25
57	74.26	11.75
58	90.50	7.50
59	84.18	12.50

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP14-2 LABEL: HYP 14 - LEVEL 2 VAR - EPs 1, 2, 3, & 12
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 14 - LEVEL 2 DIFF - CORR: FINAL SCORE vs TOTAL TIME

	TAESCORE	TAE TIME
TAESCORE	1.00000	
TAE TIME	-.33604	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 14 VAR - LEVEL 3 DIFF - TAE FIN SC vs TAE TOTAL TIME

HEADER DATA FOR: C:HYP14-3 LABEL: HYP 14 - LEVEL 3 VAR - EPISODES 4,11,14
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TAE TIME
1	72.03	10.33
2	40.99	33.00
3	79.70	8.33
4	70.83	22.33
5	70.57	18.00
6	76.10	9.67
7	64.37	17.00
8	66.30	8.33
9	80.87	5.33
10	70.57	16.33
11	52.70	32.33
12	73.54	14.33
13	44.61	21.33
14	38.20	39.33
15	61.50	23.67
16	76.43	11.67
17	53.81	20.67
18	70.73	23.33
19	72.62	7.00
20	67.09	12.67
21	52.33	30.67
22	63.56	7.67
23	68.04	13.00
24	63.82	17.33
25	35.61	25.33
26	53.33	18.67
27	69.87	17.33
28	60.17	36.00
29	70.97	16.33
30	79.74	15.33
31	56.05	21.00
32	51.66	26.00
33	43.01	22.00
34	36.79	45.67
35	80.13	11.00
36	46.30	30.00
37	72.37	18.00
38	85.43	15.00
39	65.27	20.67
40	77.83	12.33
41	73.50	11.33
42	71.63	14.33
43	76.13	14.67
44	71.83	21.67
45	75.97	13.00
46	72.94	16.33
47	79.63	10.33
48	69.84	16.33
49	77.13	18.33
50	57.77	27.00
51	50.90	29.00
52	72.10	36.33
53	60.77	28.67
54	83.10	9.33
55	55.76	22.33
56	87.50	6.67
57	41.77	38.67
58	78.07	14.67
59	54.21	45.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP14-3 LABEL: HYP 14 - LEVEL 3 VAR - EPISODES 4,11,14
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 14 - LEVEL 3 DIFF - CORR: FINAL SCORE vs TOTAL TIME

	TAESCORE	TAE TIME
TAESCORE	1.00000	
TAE TIME	-.74653	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 14 VAR - LEVEL 4 DIFF - TAE FIN SC vs TAE TOTAL TIME

HEADER DATA FOR: C:HYP14-4 LABEL: HYP 14 - LEVEL 4 VAR - EPISODES 5 AND 13
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TAE TIME
1	37.26	60.50
2	38.70	75.50
3	70.91	23.00
4	67.45	18.50
5	59.80	57.00
6	82.35	24.50
7	78.44	23.50
8	78.84	11.50
9	71.49	13.00
10	68.75	19.50
11	78.39	12.00
12	77.10	18.00
13	53.21	20.00
14	62.89	33.50
15	63.45	19.50
16	91.80	12.00
17	70.95	14.50
18	82.84	13.50
19	69.20	15.00
20	79.89	12.00
21	83.75	20.50
22	55.15	21.50
23	57.29	60.00
24	79.49	22.00
25	68.20	14.00
26	47.60	46.50
27	81.99	14.00
28	76.14	33.00
29	39.95	40.00
30	94.25	9.50
31	58.85	43.50
32	74.24	12.50
33	75.39	15.00
34	65.74	31.50
35	49.99	38.00
36	80.15	30.00
37	73.64	32.50
38	80.96	25.00
39	72.08	33.00
40	74.09	18.00
41	63.09	27.50
42	77.84	18.50
43	80.24	10.50
44	55.37	59.50
45	62.89	26.50
46	76.94	19.50
47	76.09	16.00
48	58.10	44.50
49	76.45	23.50
50	39.01	48.00
51	54.04	79.50
52	83.60	18.00
53	61.55	38.50
54	83.60	13.00
55	49.70	82.00
56	83.29	10.00
57	63.71	66.00
58	84.40	21.00
59	64.75	20.50

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP14-4 LABEL: HYP 14 - LEVEL 4 VAR - EPISODES 5 AND 13
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 14 - LEVEL 4 DIFF - CORR: FINAL SCORE vs TOTAL TIME

	TAESCORE	TAE TIME
TAESCORE	1.00000	
TAE TIME	-.73553	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 14 VAR - LEVEL 5 DIFF - TAE FIN SC vs TAE TOTAL TIME

HEADER DATA FOR: C:HYP14-5 LABEL: HYP 14 - LEVEL 5 VAR - EPISODES 6, 9, 10
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TAE TIME
1	62.25	38.00
2	55.43	19.67
3	54.50	37.00
4	27.77	57.33
5	45.58	45.00
6	83.10	20.33
7	50.15	24.00
8	10.17	71.33
9	63.12	20.00
10	39.88	45.67
11	28.13	62.67
12	43.36	47.67
13	39.96	38.00
14	28.30	37.00
15	55.20	17.33
16	38.69	48.67
17	83.45	6.67
18	56.10	43.67
19	33.94	39.00
20	44.56	39.00
21	60.83	24.00
22	36.76	22.33
23	41.73	28.00
24	63.48	36.33
25	57.28	25.33
26	36.19	47.33
27	50.03	33.00
28	49.12	60.33
29	62.73	19.33
30	44.89	52.00
31	55.79	32.33
32	63.65	10.00
33	61.92	10.67
34	44.37	41.33
35	36.92	40.33
36	49.68	31.33
37	46.93	39.67
38	44.17	67.67
39	58.06	32.00
40	56.53	21.33
41	52.39	31.67
42	40.56	39.00
43	55.25	42.33
44	42.90	65.00
45	60.42	16.33
46	36.86	39.33
47	58.56	35.67
48	51.26	25.67
49	66.43	11.00
50	59.80	21.33
51	56.50	91.00
52	47.25	51.67
53	56.29	46.33
54	50.46	34.00
55	60.39	28.00
56	53.86	22.67
57	49.89	65.00
58	59.80	28.67
59	65.73	24.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP14-5 LABEL: HYP 14 - LEVEL 5 VAR - EPISODES 6, 9, 10
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 14 - LEVEL 5 DIFF - CORR: FINAL SCORE vs TOTAL TIME

	TAESCORE	TAE TIME
TAESCORE	1.00000	
TAE TIME	-.58798	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 15

DIFFICULTY Z SCORES - EPISODE NUMBERS IN ORIGINAL ORDER

HEADER DATA FOR: C:ZSCORES LABEL: DIFF Z SCORES - EPs IN ORIGINAL ORDER
NUMBER OF CASES: 14 NUMBER OF VARIABLES: 2

	EPISODE	Z SCORES
1	2806.00	-.81
2	2948.00	-.77
3	2345.00	-.94
4	4917.00	-.19
5	8466.00	.85
6	9357.00	1.11
7	1625.00	-1.15
8	1686.00	-1.14
9	9636.00	1.20
10	12159.00	1.94
11	5393.00	-.05
12	3093.00	-.72
13	8049.00	.73
14	5311.00	-.07

HYPOTHESIS 15 VARIABLES

EPISODE	AVG STUDENT TIME	AVG INSTRUCTOR TIME	DIFFERENCE
1	6.96	6.64	.32
2	8.10	7.18	.92
3	11.46	10.09	1.37
4	19.63	22.27	-2.64
5	21.71	22.00	- .29
6	23.50	19.73	3.77
7	3.71	2.82	.89
8	4.04	3.27	.77
9	40.77	38.27	2.50
10	43.71	57.55	-13.84
11	16.54	21.91	- 5.37
12	9.10	15.91	- 6.81
13	31.58	54.36	-22.78
14	19.60	31.09	-11.49

HYPOTHESIS 15 VARIABLES - Z SCORES & TIME DIFFERENCE BET S & I

HEADER DATA FOR: C:HYP15 LABEL: HYP 15 VAR - Z SCORES & TIME DIFFERENCE
NUMBER OF CASES: 14 NUMBER OF VARIABLES: 2

	Z SCORE	TIMEDIFF
1	-.81	.32
2	-.77	.92
3	-.94	1.37
4	-.19	-2.64
5	.85	-.29
6	1.11	3.77
7	-1.15	.89
8	-1.14	.77
9	1.20	2.50
10	1.94	-13.84
11	-.05	-5.37
12	-.72	-6.81
13	.73	-22.78
14	-.07	-11.49

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP15 LABEL: HYP 15 VAR - Z SCORES & TIME DIFFERENCE
NUMBER OF CASES: 14 NUMBER OF VARIABLES: 2

HYPOTHESIS 15 - CORR: Z SCORES vs TIME DIFFERENCE BETWEEN S & I

	Z SCORE	TIMEDIFF
Z SCORE	1.00000	
TIMEDIFF	-.34656	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .45900
CRITICAL VALUE (2-tail, .05) = +/- .53067

N = 14

HYPOTHESIS 17

Note: Hypothesis16 was dropped.

HYPOTHESIS 17 VARIABLES - AVERAGE TAE SC vs AVERAGE TOTAL TIME

HEADER DATA FOR: C:HYP17 LABEL: HYP 17 VAR - TAE AVG SCORE vs AVG TIME
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TIME
1	69.68	22.57
2	60.88	26.29
3	76.64	14.14
4	70.83	22.86
5	69.46	26.93
6	81.47	13.93
7	70.49	16.64
8	55.88	22.07
9	75.45	9.29
10	70.15	19.07
11	66.05	23.57
12	73.57	17.50
13	58.61	17.93
14	56.83	24.71
15	70.87	12.93
16	73.49	19.57
17	75.85	10.07
18	75.54	18.86
19	65.63	16.50
20	69.18	16.86
21	75.34	16.64
22	61.81	14.79
23	66.73	19.21
24	72.31	17.14
25	67.35	14.79
26	60.78	24.07
27	76.54	15.14
28	67.94	29.36
29	66.67	18.36
30	78.08	18.50
31	68.05	19.50
32	71.01	11.21
33	68.19	11.36
34	66.80	26.21
35	69.62	20.93
36	65.84	21.93
37	72.05	19.86
38	75.89	24.86
39	74.63	18.79
40	76.99	12.50
41	74.49	15.79
42	71.82	17.43
43	78.35	16.93
44	68.74	32.21
45	76.29	12.36
46	70.05	17.50
47	79.77	14.50
48	70.35	18.71
49	79.74	11.00
50	67.65	20.57
51	66.20	42.93
52	74.15	25.21
53	73.51	24.36
54	80.18	13.93
55	68.85	25.43
56	81.39	10.29
57	62.35	35.50
58	81.42	15.00
59	72.20	21.79

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP17 LABEL: HYP 17 VAR - TAE AVG SCORE vs AVG TIME
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 17 - CORR: AVERAGE TAE SCORE vs AVERAGE TOTAL TIME

	TAESCORE	TIME
TAESCORE	1.00000	
TIME	-.49233	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 18

HYPOTHESIS 18 VARIABLES - TIME TILL 1ST REF DESIGN/DIAG TEST

HEADER DATA FOR: C:HYP18 LABEL: HYP 18 VAR - TIME TILL 1ST REF/DIAG TEST
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	TIMETILL
1	69.68	2.11
2	60.88	4.14
3	76.64	3.04
4	70.83	4.11
5	69.46	2.29
6	81.47	1.64
7	70.49	2.36
8	55.88	1.57
9	75.45	1.00
10	70.15	3.61
11	66.05	1.71
12	73.57	2.11
13	58.61	1.68
14	56.83	1.71
15	70.87	1.18
16	73.49	3.46
17	75.85	.36
18	75.54	1.25
19	65.63	.29
20	69.18	2.36
21	75.34	2.07
22	61.81	1.25
23	66.73	1.82
24	72.31	3.50
25	67.35	1.25
26	60.78	6.18
27	76.54	2.50
28	67.94	6.14
29	66.67	2.64
30	78.08	1.75
31	68.05	2.54
32	71.01	1.50
33	68.19	.93
34	66.80	4.43
35	69.62	2.57
36	65.84	4.46
37	72.05	2.57
38	75.89	2.79
39	74.63	3.39
40	76.99	1.21
41	74.49	4.68
42	71.82	1.79
43	78.35	1.89
44	68.74	4.82
45	76.29	1.68
46	70.05	3.04
47	79.77	2.32
48	70.35	1.64
49	79.74	1.57
50	67.65	3.57
51	66.20	3.04
52	74.15	1.75
53	73.51	2.75
54	80.18	1.86
55	68.85	2.21
56	81.39	2.61
57	62.35	5.29
58	81.42	1.61
59	72.20	2.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP18 LABEL: HYP 18 VAR - TIME TILL 1ST REF/DIAG TEST
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYP 18 TEST - CORR: TAE FINAL SC vs TIME TILL 1ST REF/DIAG TEST

	TAESCORE	TIMETILL
TAESCORE	1.00000	
TIMETILL	-.23814	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 19

HYP 19 VAR - TAE AVERAGE SCORE vs # OF O-SCOPE TESTS - S & I

HEADER DATA FOR: C:HYP19 LABEL: HYP 19 VAR - TAE FINAL SCORE vs O-SCOPE
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

	TAESCORE	O-SCOPE
1	69.68	5.43
2	60.88	.21
3	76.64	3.29
4	70.83	4.79
5	69.46	4.93
6	81.47	2.21
7	70.49	1.43
8	55.88	3.93
9	75.45	1.29
10	70.15	1.79
11	66.05	4.00
12	73.57	2.93
13	58.61	2.21
14	56.83	1.86
15	70.87	3.57
16	73.49	3.79
17	75.85	.29
18	75.54	4.36
19	65.63	1.07
20	69.18	.93
21	75.34	6.50
22	61.81	.14
23	66.73	.57
24	72.31	1.71
25	67.35	1.50
26	60.78	.64
27	76.54	2.21
28	67.94	4.64
29	66.67	.64
30	78.08	4.14
31	68.05	1.00
32	71.01	.64
33	68.19	.50
34	66.80	3.36
35	69.62	2.86
36	65.84	1.21
37	72.05	6.86
38	75.89	8.36
39	74.63	5.14
40	76.99	1.29
41	74.49	2.14
42	71.82	1.50
43	78.35	2.43
44	68.74	6.36
45	76.29	1.64
46	70.05	3.14
47	79.77	2.29
48	70.35	6.00
49	79.74	1.64
50	67.65	.93
51	66.20	3.64
52	74.15	5.79
53	73.51	7.86
54	80.18	1.71
55	68.85	2.00
56	81.39	1.14
57	62.35	6.93
58	81.42	7.71
59	72.20	2.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP19 LABEL: HYP 19 VAR - TAE FINAL SCORE vs O-SCOPE
NUMBER OF CASES: 59 NUMBER OF VARIABLES: 2

HYPOTHESIS 19 TEST - CORRELATION: TAE FINAL SC vs # OSCOPE TESTS

	TAESCORE	O-SCOPE
TAESCORE	1.00000	
O-SCOPE	.16771	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .21638
CRITICAL VALUE (2-tail, .05) = +/- .25614

N = 59

HYPOTHESIS 20

HYPOTHESIS 20 - CLASS 4/14 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-4 LABEL: HYP 20 - 4/14 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAERANK	INSTRANK
1	5.00	5.00
2	7.00	7.00
3	2.00	1.00
4	3.00	3.00
5	6.00	6.00
6	1.00	2.00
7	4.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-4 LABEL: HYP 20 - 4/14 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 4/14 - CORRELATION: TAE RANK vs INSTR RANK

	TAERANK	INSTRANK
TAERANK	1.00000	
INSTRANK	.96429	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 20 - CLASS 5/12 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-5 LABEL: HYP 20 - 5/12 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAE RANK	INSTRANK
1	7.00	4.00
2	1.00	1.00
3	3.00	3.00
4	4.00	7.00
5	2.00	5.00
6	5.00	2.00
7	6.00	6.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-5 LABEL: HYP 20 - 5/12 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 5/12 - CORRELATION: TAE RANK vs INSTR RANK

	TAE RANK	INSTRANK
TAE RANK	1.00000	
INSTRANK	.35714	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 20 - CLASS 6/9 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-6 LABEL: HYP 20 - 6/9 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAERANK	INSTRANK
1	5.00	3.00
2	4.00	2.00
3	1.00	1.00
4	2.00	6.00
5	7.00	5.00
6	6.00	7.00
7	3.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-6 LABEL: HYP 20 - 6/9 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 6/9 - CORRELATION: TAE RANK vs INSTR RANK

	TAERANK	INSTRANK
TAERANK	1.00000	
INSTRANK	.46429	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 20 - CLASS 7/7 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-7 LABEL: HYP 20 - 7/7 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

	TAE RANK	INSTRANK
1	5.00	4.00
2	4.00	1.00
3	2.00	2.00
4	3.00	5.00
5	6.00	6.00
6	1.00	3.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-7 LABEL: HYP 20 - 7/7 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 7/7 - CORRELATION: TAE RANK vs INSTR RANK

	TAE RANK	INSTRANK
TAE RANK	1.00000	
INSTRANK	.48571	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .73972
CRITICAL VALUE (2-tail, .05) = +/- .81165

N = 6

HYPOTHESIS 20 - CLASS 8/4 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-8A LABEL: HYP 20 - 8/4 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

	TAE RANK	INSTRANK
1	5.00	2.00
2	6.00	5.00
3	1.00	6.00
4	4.00	4.00
5	2.00	3.00
6	3.00	1.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-8A LABEL: HYP 20 - 8/4 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 8/4 - CORRELATION: TAE RANK vs INSTR RANK

	TAE RANK	INSTRANK
TAE RANK	1.00000	
INSTRANK	-.14286	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .73972
CRITICAL VALUE (2-tail, .05) = +/- .81165

N = 6

HYPOTHESIS 20 - CLASS 8/25 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-8B LABEL: HYP 20 - 8/25 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

	TAE RANK	INSTRANK
1	7.00	6.00
2	6.00	7.00
3	8.00	4.00
4	5.00	3.00
5	2.00	5.00
6	3.00	2.00
7	1.00	8.00
8	4.00	1.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-8B LABEL: HYP 20 - 8/25 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 8/25 - CORRELATION: TAE RANK vs INSTR RANK

	TAE RANK	INSTRANK
TAE RANK	1.00000	
INSTRANK	-.07143	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .62658
CRITICAL VALUE (2-tail, .05) = +/- .70477

N = 8

HYPOTHESIS 20 - CLASS 9/29 - TAE RANK vs INSTRUCTOR RANK

HEADER DATA FOR: C:HYP20-9 LABEL: HYP 20 - 9/29 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAERANK	INSTRANK
1	4.00	4.00
2	2.00	2.00
3	7.00	7.00
4	3.00	3.00
5	6.00	5.00
6	1.00	1.00
7	5.00	6.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP20-9 LABEL: HYP 20 - 9/29 - TAE RANK vs INSTR RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 20 - CLASS 9/29 - CORRELATION: TAE RANK vs INSTR RANK

	TAERANK	INSTRANK
TAERANK	1.00000	
INSTRANK	.96429	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 21

HYPOTHESIS 21 - CLASS 4/14 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-4 LABEL: HYP 21 - 4/14 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAERANK	CLASRANK
1	5.00	5.00
2	7.00	7.00
3	2.00	1.00
4	3.00	2.00
5	6.00	6.00
6	1.00	3.00
7	4.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-4 LABEL: HYP 21 - 4/14 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 4/14 - CORRELATION: TAE RANK vs CLASS RANK

	TAERANK	CLASRANK
TAERANK	1.00000	
CLASRANK	.89286	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 21 - CLASS 5/12 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-5 LABEL: HYP 21 - 5/12 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAE RANK	CLASRANK
1	7.00	5.00
2	1.00	3.00
3	3.00	1.00
4	4.00	6.00
5	2.00	2.00
6	5.00	7.00
7	6.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-5 LABEL: HYP 21 - 5/12 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 5/12 - CORRELATION: TAE RANK vs CLASS RANK

	TAE RANK	CLASRANK
TAE RANK	1.00000	
CLASRANK	.57143	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 21 - CLASS 6/9 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-6 LABEL: HYP 21 - 6/9 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAERANK	CLASRANK
1	5.00	5.00
2	4.00	1.00
3	1.00	7.00
4	2.00	3.00
5	7.00	6.00
6	6.00	2.00
7	3.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-6 LABEL: HYP 21 - 6/9 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 6/9 - CORRELATION: TAE RANK vs CLASS RANK

	TAERANK	CLASRANK
TAERANK	1.00000	
CLASRANK	-.14286	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 21 - CLASS 7/7 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-7 LABEL: HYP 21 - 7/7 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

	TAE RANK	CLASRANK
1	5.00	5.00
2	4.00	1.00
3	2.00	4.00
4	3.00	2.00
5	6.00	6.00
6	1.00	3.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-7 LABEL: HYP 21 - 7/7 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 7/7 - CORRELATION: TAE RANK vs CLASS RANK

	TAE RANK	CLASRANK
TAE RANK	1.00000	
CLASRANK	.48571	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .73972
CRITICAL VALUE (2-tail, .05) = +/- .81165

N = 6

HYPOTHESIS 21 - CLASS 8/4 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-8A LABEL: HYP 21 - 8/4 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

	TAE RANK	CLASRANK
1	5.00	3.00
2	6.00	5.00
3	1.00	1.00
4	4.00	2.00
5	2.00	4.00
6	3.00	6.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-8A LABEL: HYP 21 - 8/4 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 6 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 8/4 - CORRELATION: TAE RANK vs CLASS RANK

	TAE RANK	CLASRANK
TAE RANK	1.00000	
CLASRANK	.37143	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .73972
CRITICAL VALUE (2-tail, .05) = +/- .81165

N = 6

HYPOTHESIS 21 - CLASS 8/25 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-8B LABEL: HYP 21 - 8/25 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

	TAE RANK	CLASRANK
1	7.00	3.00
2	6.00	8.00
3	8.00	1.00
4	5.00	2.00
5	2.00	6.00
6	3.00	5.00
7	1.00	7.00
8	4.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-8B LABEL: HYP 21 - 8/25 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 8/25 - CORRELATION: TAE RANK vs CLASS RANK

	TAE RANK	CLASRANK
TAE RANK	1.00000	
CLASRANK	-.59524	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .62658
CRITICAL VALUE (2-tail, .05) = +/- .70477

N = 8

HYPOTHESIS 21 - CLASS 9/29 - TAE RANK vs CLASS RANK

HEADER DATA FOR: C:HYP21-9 LABEL: HYP 21 - 9/29 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	TAERANK	CLASRANK
1	4.00	7.00
2	2.00	3.00
3	7.00	4.00
4	3.00	2.00
5	6.00	5.00
6	1.00	1.00
7	5.00	6.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP21-9 LABEL: HYP 21 - 9/29 - TAE RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 21 - CLASS 9/29 - CORRELATION: TAE RANK vs CLASS RANK

	TAERANK	CLASRANK
TAERANK	1.00000	
CLASRANK	.60714	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 22

HYPOTHESIS 22 - CLASS 4/14 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-4 LABEL: HYP 22 - 4/14 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	5.00	5.00
2	7.00	7.00
3	1.00	1.00
4	3.00	2.00
5	6.00	6.00
6	2.00	3.00
7	4.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-4 LABEL: HYP 22 - 4/14 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 4/14 - CORRELATION: INS RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	.96429	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 22 - CLASS 5/12 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-5 LABEL: HYP 22 - 5/12 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	5.00	5.00
2	2.00	3.00
3	4.00	1.00
4	8.00	7.00
5	6.00	2.00
6	3.00	8.00
7	1.00	6.00
8	7.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-5 LABEL: HYP 22 - 5/12 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 5/12 - CORRELATION: INS RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	-.02381	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .62658
CRITICAL VALUE (2-tail, .05) = +/- .70477

N = 8

HYPOTHESIS 22 - CLASS 6/9 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-6 LABEL: HYP 22 - 6/9 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	3.00	5.00
2	2.00	1.00
3	1.00	7.00
4	6.00	3.00
5	5.00	6.00
6	7.00	2.00
7	4.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-6 LABEL: HYP 22 - 6/9 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 6/9 - CORRELATION: INST RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	-.35714	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 22 - CLASS 7/7 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-7 LABEL: HYP 22 - 7/7 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	4.00	5.00
2	6.00	6.00
3	1.00	1.00
4	2.00	4.00
5	5.00	2.00
6	7.00	7.00
7	3.00	3.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-7 LABEL: HYP 22 - 7/7 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 7/7 - CORRELATION: INST RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	.75000	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

HYPOTHESIS 22 - CLASS 8/4 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-8A LABEL: HYP 22 - 8/4 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	7.00	7.00
2	8.00	8.00
3	2.00	3.00
4	5.00	5.00
5	6.00	1.00
6	4.00	2.00
7	3.00	4.00
8	1.00	6.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-8A LABEL: HYP 22 - 8/4 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 8 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 8/4 - CORRELATION: INST RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	.33333	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .62658
CRITICAL VALUE (2-tail, .05) = +/- .70477

N = 8

HYPOTHESIS 22 - CLASS 8/25 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-8B LABEL: HYP 22 - 8/25 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 9 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	7.00	6.00
2	6.00	3.00
3	8.00	9.00
4	4.00	1.00
5	3.00	2.00
6	5.00	7.00
7	2.00	5.00
8	9.00	8.00
9	1.00	4.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-8B LABEL: HYP 22 - 8/25 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 9 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 8/25 - CORRELATION: INS RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	.63333	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .58607
CRITICAL VALUE (2-tail, .05) = +/- .66422

N = 9

HYPOTHESIS 22 - CLASS 9/29 - INSTRUCTOR RANK vs CLASS RANK

HEADER DATA FOR: C:HYP22-9 LABEL: HYP 22 - 9/29 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

	INSTRANK	CLASRANK
1	4.00	7.00
2	2.00	3.00
3	7.00	4.00
4	3.00	2.00
5	5.00	5.00
6	1.00	1.00
7	6.00	6.00

---------- CORRELATION MATRIX ----------

HEADER DATA FOR: C:HYP22-9 LABEL: HYP 22 - 9/29 - INSTR RANK vs CLASS RANK
NUMBER OF CASES: 7 NUMBER OF VARIABLES: 2

HYPOTHESIS 22 - CLASS 9/29 - CORRELATION: INS RANK vs CLASS RANK

	INSTRANK	CLASRANK
INSTRANK	1.00000	
CLASRANK	.64286	1.00000

CRITICAL VALUE (1-TAIL, .05) = + Or - .67649
CRITICAL VALUE (2-tail, .05) = +/- .75315

N = 7

APPENDIX C

FACTOR RANKING QUESTIONNAIRE

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER

TROUBLESHOOTING FACTORS EVALUATION QUESTIONNAIRE

INTRODUCTION

The Chief of Naval Operations (via the Vice Chief of Naval Operations for Manpower, Personnel and Training) has stated a requirement of developing a reliable and objective method for evaluation of the troubleshooting skills of Navy technicians. The Navy Personnel Research and Development Center, San Diego, California has been tasked to collect information and carry out this requirement. The name of the research and development project that is accomplishing this tasking is the **"Troubleshooting Proficiency Evaluation Program (TPEP)."**

You have been selected to participate in this effort because you are considered a Subject Matter Expert (SME) in troubleshooting Navy systems and equipment. The information that you provide will be valuable and will be used as the basis for developing a method of evaluating the troubleshooting skills of Navy personnel.

Please keep in mind, that this is not in any way a test, nor will the information you provide be released to persons other than yourself or those directly concerned with the project. You or your career will not be jeopardized in any way.

GENERAL INSTRUCTIONS

1. Please read, date, provide SSN and sign "Privacy Act Statement" provided below.

2. Please read the instructions which precede each of the two parts of the questionnaire carefully before responding to any items.

3. If you wish to change a response, be sure to completely erase (or clearly mark out if using pen) any previous response.

PRIVACY ACT STATEMENT

You have been selected to participate in the TPEP project. This project provides research data on the different levels of troubleshooting expertise associated with Navy systems and equipment. The information provided by you will be used by the Navy Personnel Research and Development Center, San Diego, for research purposes only. It will not become a part of your official record, nor will it be used to make decisions about you which will affect your career in any way. Your name, SSN are necessary only to aid in processing the research data.

Date: _____

SSN: _____

Signature: _____

SPECIAL INSTRUCTIONS PART I

PART I - BACKGROUND INFORMATION

The items in Part I concern your general background. Unless a written response is required, please place an "X" in the box which corresponds to the answer you have selected.

BACKGROUND ITEMS

1. _____, _____ _____
   Last Name First Name M.I.

2. __ __ __ - __ __ - __ __ __ __
   Social Security Number

3. _____
   Job Title (e.g., Div. Chief; Work Center Supvr.; Instructor, etc.,)

4. _____
   Rate & Rating or Rank

5. _____
   Primary NEC (current)

6. _____
   Ship or Station and Department/Division

7. My highest educational level is best described as (x one please)

   ____ Some High School

   ____ High School Diploma

   ____ Some college

   ____ Associate's degree

   ____ Bachelor's degree

   ____ Some graduate work

   ____ Master's degree

   ____ Post master's work

   ____ Doctorate degree

8. _____
   Major area of formal education

SPECIAL INSTRUCTIONS PART II

PART II - TROUBLESHOOTING EVALUATION FACTORS INFORMATION

The cards that are supplied in Part II of the questionnaire concern factors related to the evaluation of troubleshooting skills. Each card contains a description of one evaluation factor (with some example information on the factor). Please read **all** the following information and each of the "factor" cards before proceeding with the sorting instructions provided on the next page.

LIMITATION OF THE TROUBLESHOOTING FACTORS

It is understood that there are a number of factors that are involved in evaluating a troubleshooters capability and that these factors vary in importance (i.e., they have different weights). In this "ranking" the factors have been restricted, intentionally, for varying reasons (e.g., safety for personnel and hardware are not included for it is understood that if you violate safety you are a "bad" troubleshooter). Also, use of test equipment, soldering, and other "support" skills are not included. These are considered support and can be measured via other methods. "Troubleshooting," however, is considered to be a mental effort and factors are required that can be checked to see if the mental process of one troubleshooter is more efficient than another. Figure 1 shows the factors that you are being asked to rank order in the order of importance.

CONDITIONS OF TROUBLESHOOTING EPISODE

In selecting and "ranking" of factors that one would use in determining (evaluating) if one troubleshooter was more efficient than another it is necessary that the environment (e.g., war or peace, at sea or tied up, etc.) of the troubleshooting effort be identified. If the environment changes this may change the ranking results .

For purposes of this selection and ranking effort assume the following environment/conditions:

a. NON-COMBAT (i.e. peace time)
b. NORMAL DAY IN HOME-PORT
c. DURING A DAILY CHECK OF THE EQUIPMENT A TROUBLE IS INDICATED

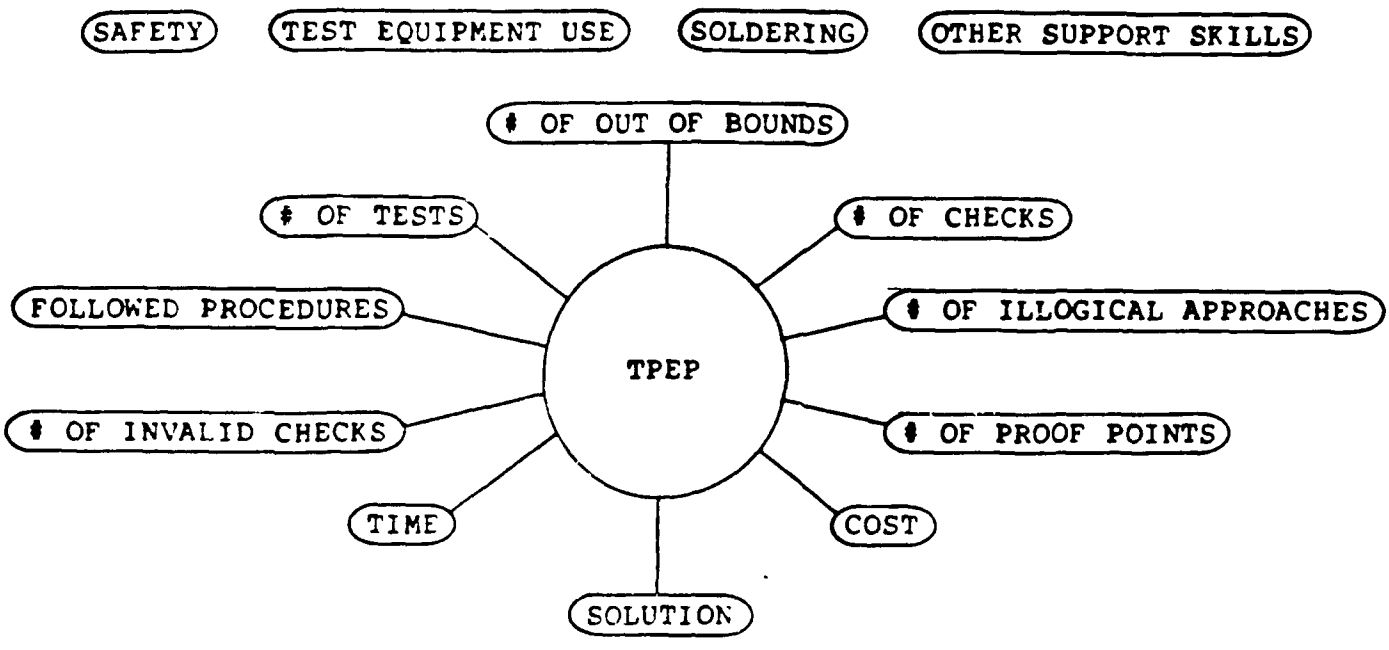

FIGURE 1. TROUBLESHOOTING FACTORS TO BE RANKED

FACTOR CARD SORTING INSTRUCTIONS

fter reading the information above and reviewing all the factor cards please perform the following steps:

1. Sort the cards according to how important the factor on a card is in evaluating troubleshooting ability.

2. Once all the cards are sorted in a sequence, circle the number on the card that corresponds to the cards position in the sequence (e.g., Most Important is card 1; Second Most Important is 2; and so-on until you get to the last card which will be number 10 and the least important).

NOTE

Make certain you have circled the appropriate number for each card (located in the upper right hand corner of each factor card).

Circle a number only once for each factor should have a different level of importance.

Circle only one number per card.

After completing the questionnaire please place all the material into the envelope provided and mail.

THANK YOU FOR YOUR COOPERATION AND CONTRIBUTION

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **FOLLOW PROCEDURES**

Factor Description/Definition: When given a troubleshooting or maintenance procedure the troubleshooter follows the directions as presented.

Example of Factor Application: The person troubleshooting a system when provided fault check or test procedures does them as directed.

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **NUMBER OF CHECKS MADE**

Factor Description/Definition: Number of checks performed to isolate the fault. These include continuity, logic, frequency, current, voltage and waveforms.

Example of Factor Application: The troubleshooter does not make a number of different tests (logic, voltage, waveform etc.) at the same test point using different test equipment when one test provides the information needed.

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **INVALID CHECKS MADE**

Factor Description/Definition: Making a wrong test at a test point given the status of the circuit or the condition of the hardware.

Example of Factor Application: The troubleshooter measures current where he should have been checking for voltage.

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **ILLOGICAL APPROACH**

Factor Description/Definition: Testing begins at a point not indicated by the symptoms. The troubleshooter may still diagnose the fault, but does not efficiently utilize the symptom data.

Example of Factor Application: If the troubleshooter begins testing on UNIT 7, even though **all** the fault symptoms and indicators (including unit 7) point to UNIT 1 as the probable fault source this is an "Illogical Approach." This applies even if the trouble could be found following this "illogical approach."

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **OUT OF BOUNDS**

Factor Description/Definition: Number of test points selected that were not relevant to diagnosing the fault.

Example of Factor Application: The person troubleshooting a system makes tests that are not reasonably in the area of where the trouble is actually located. The troubleshooter makes tests at points that have nothing to do with the problem.

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **NUMBER OF TEST POINTS CHECKED**

Factor Description/Definition: Number of test points, card pins, terminal board pins examined to isolate the fault.

Example of Factor Application: What is the total number of tests a troubleshooter makes in determining the trouble? The troubleshooter finds the solution by checking the minimum number of points.

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **COST**

Factor Description/Definition: Number of components, cards or units incorrectly identified and replaced as being the fault source.

Example of Factor Application: A troubleshooter replaces 3 cards to repair the equipment when only 1 card was bad.

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: **PROOF POINTS IDENTIFIED**

Factor Description/Definition: Number of possible input and output points of faulty circuit that were tested.

Example of Factor Application: A solution is "proven" when the minimum number of proof points have been tested which conclusively isolate the faulty component. The troubleshooter must "prove" what he was replacing was the fault?

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least
(circle 1 per card)

Factor Title: SOLUTION

Factor Description/Definition: Troubleshooter identifies the fault source/component - tech finds the trouble.

Example of Factor Application: The person troubleshooting a system does, in fact, find the cause of the trouble (e.g., circuit card, component, etc.).

TROUBLESHOOTING PROFICIENCY EVALUATION PROGRAM (TPEP)

Level of Importance
1-2-3-4-5-6-7-8-9-10
Most - - Medium - - Least

(circle 1 per card)

Factor Title: TIME

Factor Description/Definition: Time (in minutes) it takes to isolate and identify the fault.

Example of Factor Application: The amount of time it takes for the troubleshooter to discover the cause (solution) of the fault.

---------- DESCRIPTIVE STATISTICS ----------

HEADER DATA FOR: C:TPEP3 LABEL: TPEP SURVEY MASTER FILE 3-10-88
NUMBER OF CASES: 750 NUMBER OF VARIABLES: 27

TAE FACTOR RANKING

NO.	NAME	N	MEAN	STD. DEV.	MINIMUM	MAXIMUM
1	ssn	750	NA	NA	NA	NA
2	sdt	750	NA	NA	NA	NA
3	age	750	31.6453	10.9215	.0000	57.0000
4	rat	750	1.1733	.3788	1.0000	2.0000
5	pay	750	6.5733	.8001	6.0000	9.0000
6	sex	750	1.0387	.1929	1.0000	2.0000
7	flt	750	1.3147	.7539	.0000	2.0000
8	dut	750	1.8813	1.1324	1.0000	4.0000
9	rac	750	1.5053	.8312	1.0000	5.0000
10	loe	750	3.1347	1.0135	1.0000	7.0000
11	aoe	750	13.1000	9.6243	.0000	42.0000
12	job	750	3.3427	3.7657	.0000	22.0000
13	tis	750	152.4707	74.6404	.0000	355.0000
14	tad	750	41.4880	31.5327	.0000	218.0000
15	nec	750	1.6507	.9504	.0000	3.0000
16	afq	750	74.5973	24.9347	.0000	99.0000
17	aef	750	104.3373	121.1124	.0000	285.0000
18	f01	750	2.3267	2.3256	.0000	10.0000
19	f02	750	5.2600	2.8096	.0000	10.0000
20	f03	750	5.5053	2.7332	.0000	10.0000
21	f04	750	4.8960	2.3482	.0000	10.0000
22	f05	750	7.1333	2.4118	.0000	10.0000
23	f06	750	6.3880	2.4593	.0000	10.0000
24	f07	750	6.9493	2.2292	.0000	10.0000
25	f08	750	6.0667	2.7095	.0000	10.0000
26	f09	750	3.6413	2.5374	.0000	10.0000
27	f10	750	6.5907	2.3673	.0000	10.0000

APPENDIX D

FACTOR WEIGHING QUESTIONNAIRE

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER
TROUBLESHOOTING ASSESSMENT AND ENHANCEMENT

INTRODUCTION

The Chief of Naval Operations (via the Vice Chief of Naval Operations for Manpower, Personnel and Training) has stated a requirement of developing a reliable and objective method for assessing troubleshooting skills of Navy technicians. The Navy Personnel Research and Development Center (NPRDC), San Diego, California has been tasked to collect information and carry out this requirement. The name of the research and development project that is accomplishing this tasking is the **"Troubleshooting Assessment and Enhancement"** (TAE).

Previously a questionnaire was administered to over 700 Navy technicians in an effort to get an idea of the things that should be considered in evaluating whether a technician is a "good" troubleshooter or not. Also, these technicians were asked to rank order the "factors" from most important to least important.

Now it is necessary to evaluate these "factors" as they have been "ranked" and to determine the "weight" that should be applied to each factor. You have been selected to participate in this effort because you are considered a Subject Matter Expert (SME) in troubleshooting Navy systems and equipment. The information that you provide will be valuable and will be used as the basis for developing a method of assessing and enhancing the troubleshooting skills of Navy personnel.

Please keep in mind, that this is not a test, nor will the information you provide be released to persons other than yourself or those directly concerned with the project. You c your career will not be jeopardized in any way.

GENERAL INSTRUCTIONS

1. Please read, date, provide SSN and sign "Privacy Act Statement" provided on response sheet.

2. Please read the following instructions for each section of the response sheet before responding to any items.

3. If you wish to change a response, be sure to completely erase (or clearly mark out if using pen) any previous response.

TROUBLESHOOTING ASSESSMENT & ENHANCEMENT (TAE) INFORMATION

The list of "ranked" factors supplied on the response sheet concern the factors that previous subject matter experts have determined to be related to the assessment of troubleshooting skills. A description and explanation of the ranked factors is provided below. Please read **all** the following information and each of the "factor" descriptions before proceeding with the "weighing" of factors on the response sheet.

LIMITATION OF THE TROUBLESHOOTING FACTORS

It is understood that there are a number of factors that are involved in assessing a troubleshooters capability and that these factors vary in importance (i.e., they have different weights). In this "weighing" the factors have been restricted, intentionally, for varying reasons (e.g., safety for personnel and hardware are not included for it is understood that if you violate safety you are a "bad" troubleshooter). Also, use of test equipment, soldering, and other "support" skills are not included. These are considered support and can be measured via other methods. "Troubleshooting," however, is considered to be a mental effort and factors are required that can be checked to see if the mental process of one troubleshooter is more efficient than another. Figure 1 shows the factors that you are being asked to weigh.

CONDITIONS OF TROUBLESHOOTING EPISODE

In selecting, ranking and "weighing" of factors that one would use in determining (assessing) if one troubleshooter was more efficient than another it is necessary that the environment (e.g., war or peace, at sea or tied up, etc.) of the troubleshooting effort be identified. If the environment changes this may change the results .

For purposes of this "weighing" effort assume the following environment and/or conditions:

a. NON-COMBAT (i.e. peace time)
b. NORMAL DAY IN HOME-PORT
c. DURING A DAILY CHECK OF THE EQUIPMENT A TROUBLE IS INDICATED

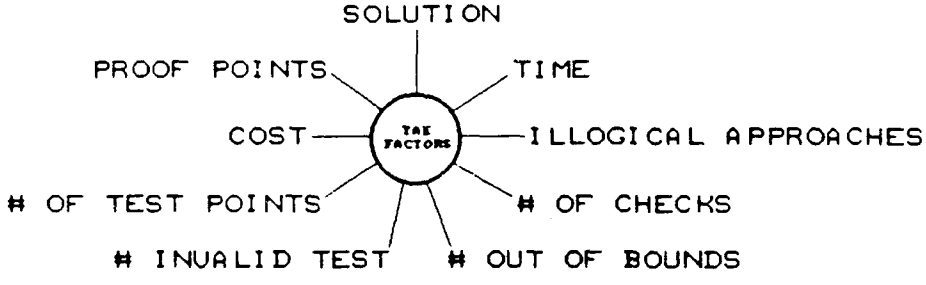

FIGURE 1. TROUBLESHOOTING FACTORS TO BE WEIGHTED

FACTOR WEIGHING INSTRUCTIONS

After reading the information above and reviewing all the factors descriptions please perform the following steps:

1. Weigh each factor (in terms of 100%) according to how important the factor described is in assessing troubleshooting ability.

2. Once all the factors are weighed please add the percentages. Ensure the result equals 100%. If the total is not 100% please modify your weightings until the total does sum to 100%. Feel free to change your weightings as you wish.

TAE FACTOR DEFINITION/EXAMPLE INFORMATION

FACTOR	DESCRIPTION	EXAMPLE
SOLUTION	Troubleshooter identifies the fault source and/or component. Tech finds the trouble.	The person troubleshooting a system does, in fact, find the cause of the trouble (e.g., circuit card, component, etc.).
PROOF POINTS	Number of possible input and output points of faulty circuit that were tested.	A solution is "proven" when the minimum number of proof points have been tested which conclusively isolate the faulty component. The troubleshooter must "prove" what he was replacing was the fault?
TIME	Time (in minutes) it takes to isolate and identify the fault.	The amount of time it takes for the troubleshooter to discover the cause (solution) of the fault.
COST	Number of components, cards or units incorrectly identified and replaced as being the fault source.	A troubleshooter replaces 3 cards to repair the equipment when only 1 card was bad.
ILLOGICAL APPROACH	Testing begins at a point not indicated by the symptoms. The troubleshooter may still diagnose the fault, but does not efficiently utilize the symptom data.	If the troubleshooter begins testing on UNIT 7, even though **all** the fault symptoms and indicators (including unit 7) point to UNIT 1 as the probable fault source this is an "Illogical Approach." This applies even if the trouble could be found following this "illogical approach."
NUMBER OF TEST POINTS CHECKED	Number of test points, card pins, terminal board pins examined to isolate the fault.	What is the total number of tests a troubleshooter makes in determining the trouble? The troubleshooter finds the solution by checking the minimum number of points.
NUMBER OF CHECKS MADE	Number of checks performed to isolate the fault. These include continuity, logic, frequency, current, voltage and waveforms.	The troubleshooter does not make a number of different tests (logic, voltage, waveform etc.) at the same test point using different test equipment when one test provides the information needed.
INVALID CHECKS MADE	Making a wrong test at a test point given the status of the circuit or the condition of the hardware.	The troubleshooter measures current where he should have been checking for voltage.
OUT OF BOUNDS	Number of test points selected that were not relevant to diagnosing the fault.	The person troubleshooting a system makes tests that are not reasonably in the area of where the trouble is actually located. The troubleshooter makes tests at points that have nothing to do with the problem.

FACTOR WEIGHING RESPONSE SHEET

PRIVACY ACT STATEMENT: You have been selected to participate in the TAE project. This project provides research data on the different levels of troubleshooting expertise associated with Navy systems and equipment. The information provided by you will be used by the Navy Personnel Research and Development Center, San Diego, for research purposes only. It will not become a part of your official record, nor will it be used to make decisions about you which will affect your career in any way. Your name, SSN are necessary only to aid in processing the research data.

Date: _____ **SSN:** _____

Signature: _____

BACKGROUND INFORMATION: The following items concern your general background. Please provide information as indicated (please print).

1. _____, _____ _____
   Last Name First Name M.I.

2. _____
   Job Title (e.g., Div. Chief; Work Center Supvr.; Instructor, etc.,)

3. _____ 4. _____
   Rate & Rating or Rank Primary NEC (current)

5. _____
   Ship or Station and Department/Division

FACTOR WEIGHING: Please ensure that the sum of the factors totals 100% -- if not please re-weigh the factors until you achieve the 100% sum.

RANKING	FACTOR	WEIGHT (in percentage)
RANKED #1.	SOLUTION	_____%
RANKED #2.	PROOF POINTS	_____%
RANKED #3.	TIME	_____%
RANKED #4.	COST	_____%
RANKED #5.	ILLOGICAL APPROACH	_____%
RANKED #6.	NUMBER OF TEST POINTS	_____%
RANKED #7.	NUMBER OF CHECKS	_____%
RANKED #8.	INVALID CHECKS	_____%
RANKED #9.	OUT OF BOUNDS	_____%
RANKED #10.	OTHER _____ (write in)	_____%
SUM OF FACTORS =		1 0 0 %

UPON COMPLETION PLEASE PLACE QUESTIONNAIRE PACKET IN AN ENVELOPE AND MAIL TO:

TAE PROJECT, CODE 142
NAVPERSRANDCEN
SAN DIEGO, CA 92152-6800

TAE FACTOR WEIGHING DATA

HEADER DATA FOR: C:FACWEIG2 LABEL: TAE FACTOR WEIGHING
NUMBER OF CASES: 45 NUMBER OF VARIABLES: 17

SSN	JOB	RATE/ING	LOCATION	FA1SOL	FA2PRP	FA3TIM
1**********	4.00	9.00	1.00	50.00	.00	20.00
2**********	1.00	7.00	1.00	35.00	25.00	4.00
3**********	1.00	6.00	1.00	30.00	20.00	8.00
4**********	1.00	7.00	1.00	40.00	20.00	20.00
5**********	1.00	6.00	1.00	20.00	15.00	5.00
6**********	1.00	5.00	1.00	70.00	10.00	5.00
7**********	1.00	6.00	1.00	40.00	10.00	15.00
8**********	2.00	6.00	1.00	40.00	20.00	5.00
9**********	1.00	6.00	1.00	25.00	15.00	10.00
10**********	1.00	6.00	1.00	30.00	15.00	10.00
11**********	2.00	7.00	1.00	70.00	5.00	10.00
12**********	1.00	6.00	1.00	70.00	.00	2.00
13**********	1.00	6.00	1.00	70.00	.00	15.00
14**********	1.00	6.00	1.00	80.00	10.00	6.00
15**********	1.00	6.00	1.00	70.00	.00	5.00
16**********	1.00	6.00	1.00	45.00	5.00	18.00
17**********	1.00	6.00	1.00	50.00	5.00	10.00
18**********	1.00	6.00	1.00	45.00	5.00	15.00
19**********	1.00	6.00	1.00	40.00	.00	30.00
20**********	1.00	6.00	1.00	50.00	.00	.00
21**********	1.00	6.00	1.00	60.00	5.00	10.00
22**********	1.00	6.00	1.00	40.00	15.00	5.00
23**********	3.00	6.00	1.00	50.00	20.00	.00
24**********	1.00	6.00	1.00	70.00	5.00	5.00
25**********	1.00	6.00	1.00	50.00	10.00	15.00
26**********	3.00	7.00	1.00	60.00	2.50	15.00
27**********	3.00	7.00	1.00	.00	15.00	30.00
28**********	1.00	6.00	1.00	25.00	10.00	15.00
29**********	1.00	6.00	1.00	20.00	15.00	12.00
30**********	1.00	6.00	1.00	35.00	5.00	12.00
31**********	1.00	6.00	1.00	20.00	10.00	10.00
32**********	1.00	7.00	1.00	20.00	10.00	10.00
33**********	2.00	6.00	1.00	50.00	5.00	8.00
34**********	1.00	6.00	1.00	90.00	.00	5.00
35**********	2.00	6.00	1.00	30.00	20.00	15.00
36**********	2.00	6.00	1.00	30.00	10.00	6.00
37**********	1.00	6.00	1.00	20.00	15.00	10.00
38**********	4.00	7.00	1.00	30.00	5.00	15.00
39**********	5.00	9.00	1.00	30.00	20.00	15.00
40**********	1.00	6.00	1.00	50.00	1.00	30.00
41**********	1.00	6.00	1.00	50.00	15.00	20.00
42**********	1.00	6.00	1.00	30.00	15.00	20.00
43**********	4.00	5.00	1.00	20.00	25.00	10.00
44**********	2.00	6.00	1.00	50.00	.00	20.00
45**********	1.00	6.00	1.00	25.00	10.00	5.00

	FA4COS	FA5ILA	FA6NUT	FA7NUC	FA8INC	FA900B	FA100TH1
1	30.00	.00	.00	.00	.00	.00	.00
2	10.00	10.00	2.00	2.00	10.00	2.00	.00
3	14.00	8.00	4.00	5.00	8.00	3.00	.00
4	10.00	2.00	2.00	2.00	2.00	2.00	.00
5	10.00	15.00	5.00	10.00	10.00	10.00	.00
6	15.00	.00	.00	.00	.00	.00	.00
7	10.00	5.00	5.00	5.00	5.00	5.00	.00
8	10.00	.00	5.00	5.00	5.00	5.00	.00
9	5.00	10.00	10.00	5.00	5.00	10.00	5.00
10	15.00	10.00	.00	.00	10.00	10.00	.00
11	5.00	.00	2.50	2.50	2.50	2.50	.00
12	10.00	2.00	3.00	5.00	5.00	3.00	.00
13	15.00	.00	.00	.00	.00	.00	.00
14	.00	.00	1.00	1.00	.00	2.00	.00
15	20.00	.00	.00	.00	.00	.00	.00
16	20.00	5.00	1.00	3.00	1.00	2.00	.00
17	10.00	5.00	5.00	5.00	5.00	5.00	.00
18	10.00	5.00	5.00	5.00	5.00	5.00	.00
19	30.00	.00	.00	.00	.00	.00	.00
20	30.00	10.00	.00	.00	10.00	.00	.00
21	5.00	3.00	5.00	10.00	1.00	1.00	.00
22	10.00	15.00	2.50	2.50	5.00	5.00	.00
23	5.00	5.00	5.00	5.00	5.00	5.00	.00
24	20.00	00	.00	.00	.00	.00	.00
25	2.00	5.00	5.00	5.00	5.00	3.00	.00
26	15.00	00	.00	.00	5.00	2.50	.00
27	20.00	10.00	5.00	5.00	5.00	10.00	.00
28	20.00	10.00	5.00	8.00	6.00	1.00	.00
29	15.00	10.00	3.00	5.00	10.00	10.00	.00
30	10.00	17.00	3.00	3.00	4.00	11.00	.00
31	2.00	15.00	10.00	10.00	13.00	10.00	.00
32	20.00	10.00	10.00	5.00	10.00	5.00	.00
33	8.00	10.00	3.00	3.00	5.00	8.00	.00
34	5.00	00	.00	.00	.00	.00	.00
35	10.00	3.00	1.00	5.00	7.00	2.00	7.00
36	5.00	20.00	7.00	2.00	13.00	7.00	.00
37	5.00	25.00	10.00	5.00	5.00	5.00	.00
38	30.00	5.00	2.50	2.50	5.00	5.00	.00
39	15.00	8.00	6.00	2.00	2.00	2.00	.00
40	10.00	1.00	1.00	5.00	1.00	1.00	.00
41	15.00	.00	.00	.00	.00	.00	.00
42	15.00	10.00	.00	.00	5.00	5.00	.00
43	5.00	30.00	.00	.00	.00	5.00	.00
44	30.00	.00	.00	.00	.00	.00	.00
45	15.00	10.00	10.00	.00	15.00	10.00	.00

---------- DESCRIPTIVE STATISTICS ----------

HEADER DATA FOR: C:FACWEIG2 LABEL: TAE FACTOR WEIGHING
NUMBER OF CASES: 45 NUMBER OF VARIABLES: 14

TAE FACTOR WEIGHING RESULTS

NO.	NAME	N	MEAN	STD. DEV.	MINIMUM	MAXIMUM
1	SSN	45				
2	JOB	45	1.5556	1.0347	1.0000	5.0000
3	RATE/ING	45	6.2444	.7433	5.0000	9.0000
4	LOCATION	45	1.0000	.0000	1.0000	1.0000
5	FA1SOL	45	42.7778	19.2636	.0000	90.0000
6	FA2PRP	45	9.8556	7.4411	.0000	25.0000
7	FA3TIM	45	11.8000	7.3719	.0000	30.0000
8	FA4COS	45	13.1333	8.0216	.0000	30.0000
9	FA5ILA	45	6.8667	7.0666	.0000	30.0000
10	FA6NUT	45	3.2111	3.2113	.0000	10.0000
11	FA7NUC	45	3.0778	2.9212	.0000	10.0000
12	FA8INC	45	4.6778	4.0887	.0000	15.0000
13	FA9OOB	45	4.0000	3.5532	.0000	11.0000
14	FA10OTH1	45	.2667	1.2685	.0000	7.0000

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